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SMITHSONIAN INSTITUTION

WASHINGTON 1846

Courtesy Du Pont Co.

Conestoga wagons, especially designed to hold 150 25-pound kegs, were used until 1889 to haul powder as far west as Pittsburgh in spite of growing network of railroads. Guarded wagon trains like this were used to transport gunpowder to United States forces during War of 1812. (From a painting by Howard Pyle.)

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SMALL ARMS AND AMMUNITION IN THE UNITED STATES SERVICE

(With 52 Plates)

By
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FOREWORD

Thousands of volumes have been written concerning the tactics, engagements, campaigns, and personnel of our American armies. In determining the outcome of our many battles of the past, the weapons we used played a part second in importance only to morale. Yet the student of military history has available but meager information on the military characteristics and performance of these tools.

A number of excellent works have been prepared in recent years cataloging the small arms employed in the United States service in the early days as to models, fabricators, and dimensional details. However, when questions arose as to effective range, accuracy, ammunition, rate of fire, and allied subjects, little could be determined without extensive research. Such fragmentary data as were readily available were likely to be found inaccurate, incomplete, or misleading.

During 1944 and 1945, while a member of the Historical Section, Office of Chief of Ordnance, my attention was brought forcibly to this lack of information. The section, in addition to its routine duties, was the clearinghouse for all questions submitted to Ordnance on obsolete materiel. Many of those comparatively simple inquiries caused us considerable trouble, as there was no definite place to look for any specific item. Fortunately we were able to find most of the answers, but it involved a lot of digging.

It appeared desirable to assemble in one place all the pertinent information that could be located on the neglected phases of our small-arms history. I decided to try to forget what little I knew on this subject and to start with a clean slate. To avoid controversy and to get as nearly accurate a story as possible, contemporary source material was used for the most part. Where conjecture enters the picture, that fact has been clearly indicated. In some cases calibers or model dates are at variance with previously published data. Government documents themselves do not always agree, but in general the descriptions used are those employed officially at the time the arm was in service. That should come close enough.

The plan was to supplement existing works rather than to amplify them. Starting from scratch, so to speak, I simply looked wherever I thought there might be some information, noted what I found, and then looked again. I had some good tips and a lot of luck. Much of

the data found was fragmentary or appeared contradictory, but gradually the blank spaces began to fill in and finally the material became so extensive that assembling the notes was the next task. It then became apparent that hearsay (often wrong) gradually tends by repetition to become the accepted story. A new search for older records was in order. Who first did what was of primary interest. It was evident that it would be helpful to minimize contradiction and uncertainty by building up a general background with a résumé of the early history of firearms and ammunition.

As information on ammunition had been the hardest to find, this subject was given the most emphasis in the search for facts. The result is the presentation for the first time of much detailed material on that topic.

The task of finding such data was simplified in a large measure by having access to the excellent military library of Col. Calvin Goddard, U.S.A. To him I am also greatly indebted for guidance and extensive counsel in the preparation of this volume.

I am grateful to the late Dr. Douglas Southall Freeman for his encouragement in undertaking this compiling job. J. M. Standish, of Berkeley, Calif., and Maj. Walter D. Kramer, Ordnance Corps, U.S.A., were particularly helpful in supplying data and photographs of specimens, and in consultation. I also wish to acknowledge the assistance of the following persons, who provided specimens for illustration, supplied source material, or made possible access to essential records:

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Many types of cartridges were identified solely through the records of Brig. Gen. John Pitman, who fought in the Civil War, later graduated from West Point, and was assigned to the Ordnance Department. He made a lifelong study of arms and ammunition, recorded his notes methodically, and left his 16 volumes of detailed information to the West Point Library. Without his efforts there would have been many more gaps in the present work.

If my work enables others interested in American military history and firearms to find the answers to some of their questions a little more easily, I shall consider myself well repaid. It has been necessary to condense some of the descriptive material and large areas of uncertainty are left. To those readers who remain alert but still uninformed, I offer my sincere apologies.

Berkeley R. Lewis,
Col., Ord. Corps, U.S.A.

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Chapter I

FIREARMS AND AMMUNITION: BACKGROUND

Since the first recorded history of man, warfare has played a prominent part in the stories handed down to us. As the cause backed by the more effective weapons usually prevailed, a study of the evolution of arms is basic to an understanding of history.

In England, before the introduction of gunpowder, the longbow was the individual soldier's arm. Under favorable circumstances it was more effective than the first muskets. Its rate of fire—12 shots per minute[1]—was many times that of any muzzle-loading gun, whereas at 11-score (220) yards more than one miss in 12 shots was considered disgraceful. At that distance the sheaf arrow would penetrate a 1-inch deal (pine) board.[2] A fair average velocity of an arrow was 135 feet per second; its striking force was only about 25 foot-pounds.[3] At one time adult English males were required to own bows and to practice regularly at a range (for flight arrows) not less than 11-score yards.[4] The bow was then to the English yeoman what the rifle later became to the American backwoodsman. Even as recently as the American Revolution, the bow was still considered by many a valuable weapon. In 1776, Benjamin Franklin wrote to Charles Lee, then fortifying the port of New York:

> . . . but I still wish that pikes could be introduced and I would add bows and arrows. These were good weapons, not lightly laid aside:
>
> Because a man may shoot as truly with a bow as with a common musket.
>
> He can discharge four arrows in the time of charging and discharging one bullet.
>
> His object is not taken from his view by the smoke of his own side.
>
> A flight of arrows, seen coming upon them terrifies and disturbs the enemies attention to their business.
>
> An arrow striking in any part of a man puts him hors-du-combat till it is extracted.
>
> Bows and arrows are more easily provided everywhere than muskets and ammunition.[5]

The crossbow (arboleste, arbalest, arbalete, arblast) was of ancient origin; a Yale expedition recovered from a battle site of A.D. 256 typical iron-tipped crossbow projectiles protruding from remnants of Roman bronze-scale armor. The maximum effective range of the

military crossbow was 200 paces, its point-blank range 40 to 60 yards.[6] Though the weapon played an important part in the conquests of Mexico and Peru by Cortez and Pizarro, at the end of the sixteenth century it had been almost completely abandoned. However, as late as 1627 the English still had crossbowmen in their army.[7] At the end of the eighteenth century extensive crossbow experiments were conducted at Amecy, France. Records of these show that quarrels fired almost horizontally attained 400 paces, the least 260, and the average about 320 (the pace used was equivalent to 18 to 20 inches).[8] Although a powerful weapon, the crossbow's ballistics were fundamentally bad, as its string (up to $\frac{5}{8}$-inch diameter) weighed about as much as the projectile and hence absorbed half the available energy. Its rate of fire was only about one shot per minute, but when its bolt struck it was deadly.

The first firearms in Europe were probably made at the beginning of the fourteenth century, as writers of about 1290 describing in detail weapons in current use did not mention firearms.[9] Ibn Nason ben Bia, of Grenada, said that guns were introduced into Spain by the Moors and used there in 1305 at the siege of Ronde; also that in 1331 balls of iron were fired.[10] The former date is contested but is probably about right. Other authors appear to be mistaken in ascribing much earlier dates to the first use of firearms in Spain. For example, Condé in his "History of the Moors in Spain" said that in 1118 they used artillery against Zaragossa and in 1132 made a 4-pound-caliber culverin, named "Salamonica." These and similar statements are based on misunderstandings or poor translations. In the days of the first firearms, names of various types of mechanical war-engines long in use were applied additionally to the new weapons, so that often a single noun designated two or more entirely different objects. In the Zaragossa instance inspection of the Spanish text shows that the machine threw balls *with* fire (incendiaries), not by means of fire.[11]

Cannons were made in Italy around 1312; they were stone-throwing mortars known as *vases de fer* from their shape.[12] The town records of Ghent contain several entries which indicate that guns and powder were exported to England in 1314.[13] The records of the Republic of Florence show that in 1326 it ordered several metal cannon, including balls for them, for defense.[14]

The first use of firearms in battle recorded by contemporary writers was at Metz, in 1324, as described in Praillon's "Chronique de Metz," written in 1326.[15] He used the terms *"serpantine et cannon, . . . collevrine . . . poldre"* in a manner difficult to interpret as referring to other than artillery using gunpowder.

In 1327 Edward III used "crakeys of war" (cannon) in his invasion of Scotland, as described in 1375 by Archdeacon Barbour of Aberdeen.[16]

During the fourteenth century, cavalry was armed with small culverins (collevrine, couleuvrine), short cannon, lengthened to the rear by an iron stock. The pieces were directed by the left hand.[17] These first hand-firearms were crude iron or copper tubes, fired by applying a live coal to a touchhole.[18] This was a shallow cup at the top of the breech, whence a small hole led downward into the powder chamber. Having filled this depression with powder, the gunner applied a flame, which passed down the vent, firing the charge—usually. Most of the trouble experienced with firearms during the succeeding 500 years was caused by faults in this ignition system. During those five centuries the gunner could expect at least one "misfire" in ten shots.[19]

In 1364 pistols were first made at Pistoja, Italy. They had span-long barrels (about 9 inches) and were then known as "bombardelles." The use of the modern name—said to be from the place of their first manufacture—dates from early in the sixteenth century, when these weapons had barrels up to 25 inches long and a knob-ended stock with but little drop.[20] In 1544 such weapons were used in the French cavalry.[21] It has been said also that the name originated from the caliber, it being the same size as the coin "pistole."[22] In 1373 guns were common enough for Chaucer to write, "Swift as a pillet out of a gonne,/When fire is in the pouder ronne." Hand cannon were brought to England by Edward IV, when he landed at Ravenspur in 1471 with 300 Flemings so armed. This weapon, 4½ feet long and weighing 60 to 75 pounds, was carried by two men and fired from a rest, using balls of four or five to the pound. Difficult to load and uncertain in range and accuracy, it was inferior to the crossbow, then still in use.[23] These early hand cannon were fired by a hot wire inserted into the touchhole. Though sure, this means of ignition was by no means handy for field use, as a fire had to be kept burning close by.[24] Later, the weight of the hand cannon was reduced by making it shorter. The breech of the resulting arm terminated in a handle for the right hand; ignition was by means of a match applied by the left. It was used for sieges and to defend important places. After this the hand cannon was made somewhat lighter and enclosed in a wooden stock, the butt being applied to the shoulder or breast in firing, the right hand holding the match. As it was still very heavy the muzzle was supported by a crotched stick placed in the ground. The extreme

range of this piece was 200 to 300 yards, the effective range only about 50 yards.[25]

Early in the fifteenth century [26] the Spanish invented the matchlock,[27] to make loading safer and to give steadier aim while applying the match. They added a cover to the pan or bassinet (which had been moved to the side of the barrel) to protect the priming powder from wind and rain. The matchlock trigger mechanism—the first applied to a firearm—was simply that of a crossbow with a match holder added. (Pl. 1a.) The first military application of this new invention was known as the arquebus [28] (harquebus, hagbut, hakenbüchse). It had a straight stock patterned after that of a crossbow. The haquebus was an arquebus with a curved stock. These weapons were probably inferior to the longbow on the battlefield.[29] The arquebus succeeded hand cannons or culverins in field service, restricting their use to sieges. With these earliest firearms, it was customary to use a wooden wad or sabot to confine the powder and give more time for the gas pressure to develop. It was necessary to use a strong iron rod with a mallet or other heavy instrument to seat the charge properly.[30] The first military use of the matchlock musket was in 1414, at Arras.[31] The Swiss used the arquebus in 1476, the English in 1485, when half the Yeomen of the Guard, then first established, were armed with it.[32] In 1510 France adopted a ball of 16 to the pound,[33] the largest shot without a muzzle support.[34] The petronel (petrinal, poitrinal), introduced in 1449,[35] was a lighter arquebus (weight about 16 pounds) having a curved butt with a broad base. It was fired against the breast, which is the origin of its name. The petronel was used in cavalry and infantry sizes. The caliver was originally a heavy, large-bore arquebus; the term was sometimes used later for most any old-fashioned musket. A contemporary stated, "It is supposed by many that the weapon called commonly a caliver, is another thing than a harquebus, whereas in troath it is not but onely a harquebus, saving that it is of a greater circuit or bullet than the other is of, wherefore the Frenchmen doeth call it a 'peece de calibre', which is as much as to say, a peece of bigger circuite." [36]

About 1521 the mousquet [37] (moschetto, muschite, musquet, musket), with double the charge and caliber of the arquebus, was introduced in Spain and used that year at the siege of Rhege. As it was 6 or 7 feet long and at first weighed up to 60 pounds, a rest was necessary for firing and was usually carried by the mousqueteer.[38] His attendant followed with the arm. This piece was very slow in loading, not only by reason of its unwieldiness but because powder, priming, and ball were carried separately, and time was required to

prepare and adjust the match.[39] The Spanish Army standardized them in 1565. In 1573 the mousquet began to replace the small-bore arquebus in France, but some of the latter remained in use until 1635. It had greater range and effect than the later (eighteenth and nineteenth century) flintlock muskets.[41] The Swedish Army retained some of these early muskets in service until 1811.[42] The term musket was later used to mean a fusil, a lighter version of the musket used after flint ignition was adopted.[43] The carbine (carabine) [44] was originally a short caliver of large bore; the blunderbuss (thunderbus, dundre busse) still shorter and larger and equipped with a bell-muzzle. A variety of blunderbuss was known as a "dragon," its users "dragoneers" (later dragoons). The musketoon was derived from a short-barreled petronel, which had been introduced for cavalry use about 1480. In 1559, the musketoon was first used in the French cavalry, and in 1626 it replaced the carbine.[45] Some of these terms meant different things at different times and places.

At about the end of the fifteenth century the wheel-lock,[46] the first mechanical device to displace the smoldering match, was invented, probably in Germany. (Pl. 1b.) The oldest known specimen, dated 1509, is in an English collection; another was made in 1517, at Nuremberg.[47] The snaphaunce, or "Spanish" lock,[48] was invented at about the same time as the wheel-lock. (Pl. 3a.) It was probably introduced to the Dutch from Spain, and made an early appearance in Scotland. Considerably more complicated and costly than matchlocks, the wheel-lock and snaphaunce saw more sporting than military use.

At the beginning of the seventeenth century, the lock *a la Miquelet* [49] began to predominate in the Mediterranean area (pl. 3b), and the flintlock had about reached its final form (pl. 4a). In fact, by that time flintlock muskets were in the hands of the Indians in North America.[50] It is generally thought that the flintlock first appeared sometime during the first two decades of the seventeenth century [51]; however, the Musée d'Artillerie in Paris has one dated prior to 1550. A large series of flint gunlocks has been recovered from the sites of Iroquois villages, destroyed in 1687 by the French under the Marquis de Denonville. These locks seem to date from 1620 to 1680.[52] In about the year 1630, the flintlock musket, or fusil, was introduced into France and adopted by the French Army in a royal ordinance dated February 6, 1670. An ordinance of October 24, 1670, established 29 companies of grenadiers of 70 fusiliers each. On February 4, 1670, the first regiment entirely armed with the fusil was authorized. The Carrignan regiment was so equipped in 1676 and saw service with

them in America. At first the fusil displaced only a part of the mousquets. By 1692 they were on a 50-50 basis for general service, and in 1699 the mousquet was officially declared obsolete.[53] In about 1677 the British adopted the new weapon, all Europe was using it by 1707,[54] and for the next 140 years it continued as the principal infantry weapon, without major improvements.

There were several transition types of locks between the wheel-lock and later forms. One (pl. 4b) was known as the "Baltic" or "Courland" lock; another (pl. 5a) was used in Holland. As pyrites is very friable, it often fell apart at the crucial moment. To remedy this embarrassing condition, some wheel- and snaphaunce locks were made with two cocks. Combinations of types are also found—matchlock wheel-lock, or matchlock flintlock. True double locks (with two pans) were made for multi-barrel guns.

The first recorded organized target practices with firearms were at Nuremberg in 1429 and at Augsburg in 1430. In 1450 shooting prizes were established in Switzerland, and by 1525 there were many associations encouraging marksmanship in France. About 1515 the "Knights of the Arquebus" was organized in Flanders.[55]

About 1539 the 33d Statute of Henry VIII legalized the possession and use of hand-guns for target practice.

> Provided alway, and be it enacted, etc., that it shall be lawful, from henceforth, to all gentlemen yeomen, and servingmen of every lord, spiritual and temporal, and of all knights, esquires, and gentlemen, and to all the inhabitants of cities, boroughs, and market towns, of this Realm of England, to shoot with any hand-gun, demihake, or hagbut, at any butt or bank of earth, only in places convenient for the same; so that every such hand-gun, etc., be of the several lengths aforesaid, and not under. And that it shall be lawful, to every of the said lord and lords, knights, esquires, and gentlemen, and the inhabitants of every city, borough, and market town, to have and keep in every one of their houses such hand-gun or hand-guns, of the length of one whole yard, etc., and not under, to the intent to use and shoot in the same, at a butt or bank of earth only, as is above said, whereby they and every of them, by the exercise thereof, in form above said, may the better aid and assist to the defence of this realm, when need shall require, etc.

The plug bayonet was first made about 1640, traditionally at Bayonne. This was simply a blade with a tapered cylindrical base or tang, which was inserted in the muzzle of the gun. In 1678 Philip Russel of England invented a screw-attached bayonet, which could be left attached while loading and firing. First use of this in battle was made by the Swedes, firing with fixed bayonets.[56] By 1703 France had abandoned pikes and musquets for infantry, which was then all equipped with the flintlock fusil and bayonet.[57]

The oldest rifles extant are of German origin, dating from the end of the fifteenth century, though the idea may have originated in Italy, then the home of some of the world's best armorers of that or any other period. In 1498 grooved barrels were used in Leipzig, and by 1520 Augustin Kutter (or Koster) of Nuremberg had become celebrated for his so-called "rose" or "star-grooved" barrels having *spiral* form.[58] The story has been oft repeated that rifle grooves were originally straight and intended simply to provide space for the accumulation of fouling in order to reduce loading friction. It continues to the effect that it was accidentally found that a twist gave more accurate shooting. There is no doubt that a grooved bore allowed use of a tighter-fitting ball, but since there existed some crossbows equipped with spiral grooves to spin the quarrel,[59] it does not seem likely that this effect would have been so soon forgotten. In 1635 the first English patent for rifling gun barrels was issued to Arnold Rotsipen.[60]

For many years after its introduction the rifle was purely a sporting arm. It was not until 1631 that the Landgrave of Hesse armed three companies of chasseurs with that weapon. In 1645 Elector Maximilian of Bavaria equipped three light-infantry regiments with rifles, intending to employ them in the minor operations of war. Frederick William of Prussia, in 1674, distributed a few riflemen among his infantry companies. Some years later Frederick the Great added a specially trained rifle company to each infantry battalion. About 1674 Louis XIV armed some cavalry squadrons with *carabines rayées*.[61] But it was nearly 200 years later before the rifle became the predominant infantry weapon.

In a tract read before the Royal Society in 1746,[62] Benjamin Robbins observed that ". . . the degree of spirality, the number of threads, or the depth of the channels, is not regulated by any invariable rule, but differs according to the country where the work is performed and the caprice of the artificer."

He then proceeded to discuss loading:

. . . but in some parts of Germany and Switzerland an improvement is made by cutting a piece of very thin leather or fustian [a coarse, twilled material] in a circular shape, somewhat larger than the bore; this being greased on one side, is laid upon the muzzle with its greasy part downwards, and the bullet being placed upon it, it is then forced down the barrel with it. The riflings should for this purpose be shallow, and the bullets not too large. As this mode of loading took up a good deal of time, the rifled barrels made in England (for I do not remember to have seen any foreign rifles so constructed) are contrived to be charged at the breech, where the piece is made larger, and the powder and bullet are put in through an opening in the side of the barrel, which, when the piece is loaded, is fitted up with a screw.[63]

This statement indicates that the patch, instead of being an American invention, was no doubt introduced to America by Swiss or German gunsmiths along with the rifle.

Brought to America about 1650-1700, the rifle was soon adapted to the conditions of the new land, retaining the best features of its central European prototype but acquiring distinctly new characteristics. Powder charge and barrel length were increased to obtain better performance, and bores were made smaller to conserve lead. The result was the first type of rifle with which a skilled marksman could be sure of hitting the target at 200 to 300 yards range. Use of these weapons (at first made for the most part in Pennsylvania, but known as "Kentucky" rifles) was restricted almost entirely to frontiersmen. During the Revolutionary War those used by the United States Army were mostly supplied by their private owners, volunteering for service. Such rifle troops, recruited in the backwoods, did magnificent work upon several occasions then and during the 1812 War as well. Indeed, in 1804 the United States adopted a rifle for army use and began to manufacture it at Harpers Ferry Armory. This, however, was more nearly a copy of the original German rifle, had most of its faults, and lacked the advantages of the "Kentucky." The 1804 model employed a heavy charge (100 grains of rifle powder) but fired it in a short, large-bore barrel, not too carefully rifled with deep grooves. The result was inferior accuracy, accompanied by a fearful recoil. The weapon was, even so, far superior in range and accuracy to the smooth-bore musket, the principal United States arm at that time. The old military rifle was never employed by troops generally and was unsuited for such use.

During the Peninsular War, British riflemen were supplied with balls of two sizes, the smaller intended for quick loading.[64] Baker, who made these rifles, says in his work published in 1825, "I have found 200 yards the greatest range I could fire at with any certainty. I have fired very well at 300 when the wind has been calm. At 400 and 500, I have sometimes struck the object, though I have found it to vary much." The earlier "Ferguson" rifle was tried briefly during the American Revoluntionary War, but apparently interest in it died with its designer, at Kings Mountain.

The 2-grooved rifle, employing a belted ball—a Spanish invention of 1725—was standardized for the British Army in 1836 as the "Brunswick" rifle. It would not perform even tolerably well at ranges much greater than 300 yards.[65] At various times, oval bores have interested arms makers. Writing in 1808, Colonel Beaufoy said:[66]

> While enlarging on rifles with grooves, let us not pass over a very old invention (though quite obsolete in our time), which is the method of making a plain-

barreled gun possess the advantage of the rifle, yet not be liable to detection unless more minutely examined than common inspection leads us to expect. . . . These barrels are loaded in the usual way, except that the ball should be sufficiently large to fill up the whole of the indentation; and it is said that such as are accustomed to these pieces will far outstrip anything that can be done with the common smooth-surfaced *cylindrical* barrel. It would be an improvement, though, instead of using a spherical ball with these pieces, if it were rather of an oblong shape.

Other forms were used. The hexagon bore, perfected by Whitworth, could be given a very rapid twist without stripping the projectile. Whitworth used a twist as great as one turn per inch, though he found that one in 20 inches gave the best performance.[67]

New ideas in weapons are rare. In 1521 an all-steel, 2-shot, revolving, wheel-lock, rifled pistol was made in Italy. Some of the earliest cannon were loaded at the breech, and in 1540 Henry II of France applied the breech-loading idea for cannon to an arquebus, opened by a hinged block.[68] Arms operating on the revolver principle have been made for centuries. A matchlock revolver in the Tower of London was made about 1550. There were various early flintlock types, but they did not start to become practical until the first part of the 19th century. In 1818, Artemus Wheeler of Boston patented a flintlock revolver in the United States, and that same year his associate, E. H. Collier, took out a British patent on essentially the same system and in 1821 registered a patent for a percussion type in England. Devisme of Paris patented a 7-shot percussion revolver in 1822; Hermann of Liége followed, then Mariette, Colt, and a host of others. In the 1840's good metallic-cartridge revolvers were produced in France. Two general types of revolver action were used at first. In that predominant in America, the hammer had to be "cocked" with the thumb for each shot and was released by pressure on the trigger. In Europe another type was popular, in which there was no provision for external cocking of the hammer; a continuous pull on the trigger first forced the hammer back, then released it. This action was used in America for many of the "pepperbox" revolvers but not to any extent for the military or belt types. A revolver that operated by one or the other of these systems was known as a "single-action" gun. Later, both types of mechanism were incorporated in the same revolver, which was then described as . . . "double action (a combination of) . . . firing from the trigger (and firing from) . . . full cock, either method being available as preferred." [69]

The arquebusier carried a flask of ordinary powder, a bag of bullets, and a small case for priming powder. Soldiers were served one pound of common powder for loading and a quarter of a pound of

fine for priming.[70] About 1550 the bandolier (bandeleer, bandileer, bandaléer) came into use in parts of Europe to carry charges, avoiding the danger inherent in loading with loose powder in the presence of a burning match.[71] To it were hung several little cases of wood, covered with leather, each containing a charge of powder. (The cases were not expendable.) Balls and priming powder were still carried separately. During the time of Charles I an official document listed accoutrements as follows: ". . . a new bandalier, carrying twelve charges, a primer, a priming wire, bullet bag, and a strap or belt two inches broad, 2s, 6d." [72] (See pl. 2.) With use of the cartridge, the cartridge box replaced the bandolier.[73] These changes resulted in three times the former rate of fire—infantry could now fire two rounds per minute.[74]

"Bags of linen or paper" for cannon charges were mentioned in 1560,[75] and in 1590, Sir John Smythe spoke not only of cartridges, but of composite cartridges for small arms—". . . cartages with which [musketeers] charge their peeces both with powder and ball at one time." [76] Soldiers then carried 20 to 40 paper cartridges in a leather pocket. In the time of Charles II of England, Sir James Turner spoke of horsemen using cartridges carried in a "patron"—an early term for a horseman's cartridge box.[77] In 1620 the army of Gustavus Adolphus was the first to standardize the use of measured powder charges in paper packets. His musketeers each carried 12 cartridges with the bullets attached.[78] From about 1683, use of the cartridge was general by most infantry, but it was not officially adopted by France till 1702.[79] Other weapons, such as rifles and pistols, continued to be loaded with flask and loose ball. Indeed most reserve ammunition and that used by militia and volunteers were of that type. In 1781 the Prussians used a funnel-shaped touchhole, to be self-priming from the main charge. The idea had been tried earlier in the century in Nuremberg by Hautch.[80] Eventually, as powder became better in quality and granular in structure instead of mealed, it was possible to dispense with the priming flask, as sufficient powder passed from the barrel through the touchhole into the pan to assure ignition. Part of the main charge was then used to fill the pan.

Fulminates were described in France in 1785 to 1787, and some had been discovered in other countries as much as two centuries earlier.[81] Pepys mentions fulminate under the date November 11, 1663: "Something made of gold, which they call in chymistry Aurum fulminans, a grain, I think he said [a German scientist with whom he was talking], of it put into a silver spoon and fired, will give a blow like a musquett, and strike a hole through the spoon. . ." There are

several vague references to earlier use of detonating locks (pl. 5b), but until 1807 these substances were little used in firearms.[82] In that year Le Page made a fulminate lock, and Forsyth soon after patented a percussion system in England (demonstrated by him some years before) which used a detonating mixture containing potassium chlorate.[83] A few years later (in 1814) an American, Shaw, made the first true percussion caps, using mercury fulminate in an iron cap. Later copper and pewter were successively employed.[84] About 1820 Deboubert invented the exterior nipple and Blanchard of Paris made percussion caps with fulminate, in about the forms which continued in use for the succeeding 50 years.[85]

Though some breech-loading and repeating arms were made in the flintlock and earlier periods, development of successful weapons of these types was greatly handicapped until metallic ammunition became available. Many of the early percussion breech-loaders were French; several used metallic cartridges. The Pottet and Pauly were made in the 1820's, the Robert in 1831. The Perrin le Page, Montigny, Lefaucheax, and others followed. In 1826 Cazalat made a cartridge of special interest as the first to be drawn from a single sheet of metal and to contain a center-fire primer. In 1834 Robert introduced an annulus at the base of a metallic cartridge for fulminate—the first rim-fire ignition. In 1846, Houllier invented the pinfire cartridge, the first "gas-tight" ammunition, in which a metal cap was placed in a wad at the base of the cartridge tube, and fired by a pin which projected through both cartridge and breech.[86] Flobert invented a ball with a charge of fulminate in its base, constituting both priming and propellant. (See Appendix 3.) The Smith and Wesson patent of 1856 used the same principle.[87]

In 1819 the United States Army adopted Hall's breech-loading flintlock rifle, which Thornton and Hall had patented in 1811. In 1834 the percussion version was standardized as a carbine. Then followed a series of percussion breech-loading actions, all more or less unsatisfactory from lack of obturation (gas seal at the breech) until metallic ammunition became available.

In the early days arrowlike projectiles—somewhat like crossbow quarrels—were often fired from muskets. These continued in use for some time. In 1588, Sir Francis Drake added a postscript to a return of the powder aboard his squadron, "Forget not the 500 muskets, and at least 1000 arrows." A short time after, the Privy Council ordered him to be supplied with "muskittes 200; arrows for the said muskittes with tamkines for eche, 1000." [88] These may have been fire-arrows, for use against sail and rigging.

Buckshot, "swan drops," and small shot were in use in Italy about the middle of the 16th century. Later a shot industry was established in Paris, and then in England. In 1669 it was stated that wing shooting had then been known in Italy for about 80 years.[89] In 1920 Gustavus Adolphus introduced grape shot.[90] In 1672 Geisler used shells filled with musket balls fixed with pitch at the siege of Lille. The Shrapnel shell, perfected later, was a revival of the same idea. The first explosive shells (1678) were fired by concussion on impact.[91] Most later types were fired by a powder-train fuze.

The principal disadvantage of the flintlock was the slow lock time, as an appreciable delay occurred between the fall of the cock and powder ignition. In 1703 loading of the French musket was done in 26 counts, hardly conducive to rapidity of fire.[92] Smooth-bore arms were improved only slightly after the French model of 1777, and most of them used a round ball of caliber 0.69 inch, or 18 to the pound, though they differed in detail in the various armies.[93] The loose-fitting round ball fired from the typical smooth-bore musket was capable of only the most erratic flight. During its course down the barrel it bounced from side to side, finally leaving the bore with a spin imparted by its last contact. This point could not be determined, and so an unpredictable error was introduced. As a result volley musket fire was ineffective at much greater ranges than 150 yards, and a person could be considered safe from aimed fire at 300 yards. The British "Brown Bess" musket (about the poorest) [94] had a range not much over 125 yards, with poor accuracy at any range.

The ball had always been made undersized because of the difficulty in loading a tight-fitting one in a fouled barrel. During the first part of the nineteenth century much thought was given to means for remedying this situation. There were two general approaches to the problem; the ball could be loaded from the breech (a practice not highly regarded by the military) or some means could be provided for upsetting the ball (enlarging to fit the bore) after loading from the muzzle. In 1729 it had been found that good results could be had with rifles firing oblong elliptical projectiles,[95] and in 1742 Robbins pointed out the superiority of oval over elongated bullets. Great difficulty of loading—ordinarily by means of an iron ramrod and a mallet—prevented extensive military application of these observations until 1828, when Captain Delvigne adapted the oval ball successfully to military service.[96] His projectile was upset so as to fill the bore by ramming it against the rim of a powder chamber of less than bore diameter. Many variations and modifications followed. These improvements in muzzle-loading rifle balls may be classified in three main groups.

In the first, the ball was simply inserted and the attempt was made to preserve its original shape (as the Minié). In the second, the ball was uniformly disfigured before firing, during the ramming operation (as the Thouvenin). The third group, in which the balls were patched, had little military use, being confined almost entirely to American sporting rifles. To avoid the unfavorable results brought about by the disfiguring of the ball in ramming, Delvigne put a cup-shaped head on the rammer and grooved out the central portion of the ball, filling it with grease to reduce loading friction. This was the inception of the grooves that later became universal on pointed balls.

Meanwhile Colonel Pontchara had added a wooden sabot to prevent the ball being driven into the chamber, thus crushing and compressing the powder (fig. 1). Then Colonel Thouvenin removed the sabot and

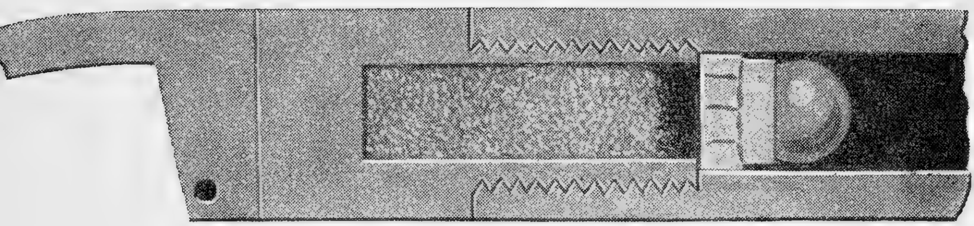

Fig. 1.—Pontchara system.

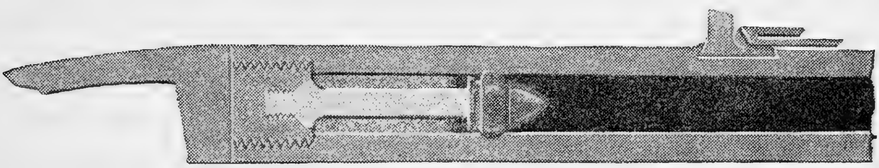

Fig. 2.—Thouvenin system.

used a steel post, or *tige,* in the center of the chamber, around which the powder charge was placed (fig. 2). The ball entered freely and rested on top of the post, where it was upset by a heavy ramrod. This system had the disadvantage that the chamber *a tige* was hard to clean. A modified Delvigne ball, with multiple grooves instead of a single large one, was developed. Combinations of these various types were tried in European armies.[97]

In 1823 Captain Norton designed a hollow-base cylindro-conoidal bullet, which expanded on firing and sealed the bore.[98] Later, in 1836, Greener inserted a conical pewter wedge in a cavity at the base of a round ball. The expanding gases forced part of the bullet into the grooves. In 1841, he submitted to the British Board of Ord-

nance an oblong bullet having a conical iron plug in a hole at its base. Both types were fired successfully but were rejected for service.[99] In 1851 Minié accomplished the same thing by using a sheet-iron cup (fig. 3). It was soon discovered that with a cavity of suitable size and shape, the wedge was not necessary. The Wilkinson system used a flat-based bullet and obtained the desired expansion by deep grooves

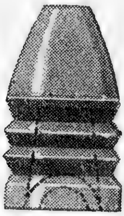

FIG. 3.—Minié system.

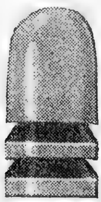

FIG. 4.—Wilkinson system.

cut in the cylindrical parts[100] (fig. 4). During the American Civil War most services were using some modification of these methods.[101]

The gradual improvement in gunpowder, both as to power and to consistency of performance, played a part of great importance in the evolution of firearms. Without the development of a dependable propellant, the increased knowledge of ballistics and the improved techniques in construction of firearms could have resulted in comparatively little actual progress.

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28. From the Italian *arca bouza,* meaning "bow with hole."
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34. According to Piobert, this was reduced to 19 per pound, when cartridges came into use, to allow for the paper covering.
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36. Barwick, Humfrey, Discourse concerning the force and effect of all manual weapons of fire, London, 1591.
37. The mousquet was the name for the male sparrow hawk, smallest of falcons. The firearm given this name had about 1-inch bore, using eight balls to the pound. At the end of the sixteenth century the Spanish were still using 10 balls per pound. Walhausen, Art militaire.
38. Piobert.
39. *Ibid.*
40. *Ibid.*
41. Boutell.
42. Piobert.
43. From the Italian *focile,* meaning flint. Fossil has the same root.
44. The name appears to have originated in the word *karib,* Moorish for cavalry, the arm first using this weapon.
45. Piobert.

46. In the wheel-lock a grooved steel wheel, actuated by a powerful spring, spun through half a revolution against a piece of alloy composed of iron and antimony (later pyrites was used). The contact took place at the bottom of the panful of priming powder. The action was much like that of a modern cigarette lighter—sometimes it did not work either.

47. Boutell.

48. In the snaphaunce lock a piece of pyrites was snapped down against a roughened piece of steel, throwing sparks into the priming pan. The pan was uncovered by the forward motion of the cock (the clamp holding the pyrites), just as in the wheel-lock.

49. In the Miquelet lock, flint was used and the pan cover became part of the steel against which the flint struck. The trigger retracted a pin which had projected through a hole in the lockplate, holding the cock back. The same mechanism had been used in the wheel-lock. In the Spanish form of the Miquelet lock, the external main-spring bore against a projection at the rear of the cock, pushing upward. In the Italian form (pl. 3b) the spring pressed downward on the front side of the cock. The typical Spanish spring action may be seen on the later fulminate lock illustrated on plate 5b.

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64. The difficulty of loading the rifle was the great argument used against it by the armies, which insisted on retaining the smooth-bore musket solely on the grounds of its more rapid rate of fire. With typical inconsistency repeating arms were later rejected because they would shoot too fast. Unless it was sponsored by top authority, intermediate officialdom has always had a ready excuse for resisting change.

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Chapter II

GUNPOWDER IN AMERICA

The employment of gunpowder in Europe revolutionized warfare and had a profound effect on most human institutions. As the great equalizer, gunpowder was a major factor in the decay of feudalism. It certainly played a large part in the expansion of the European nations into the rest of the world. As nitre, or saltpeter, is the essence of gunpowder, and appears to have been unknown before the thirteenth century, the gunpowder story really begins at about that time.

Incendiary mixtures and fireworks in general appear to have originated, at some remote date, in India or China. Their principal ingredients were sulphur, pitch, and naphtha. As early as 413 B.C. Greek fire and similar compounds were used at the siege of Syracuse; about 350 B.C. a special incendiary for naval use was recommended by Aeneas.[1]

In the seventh century the Greeks invented a new species of incendiary, known as "sea fire." The nature of this mixture remained a state secret for some 500 years. A combination of sulphur, quicklime, and oil, made into lumps, was discharged from flexible tubes by pressure of water, which also served to ignite the mixture. Western authors were ignorant of the manner of using sea fire and did not even know its name. About 1200 it seems to have gone out of use.[2]

Greek fire was used as late as 1571, when the Venetians poured it onto the heads of the Turks. The English employed "wildfire"—their version of Greek fire—in the Crusades. Similar compositions are still employed in warfare, but no longer under their original names, which have passed into history.

Roger Bacon is credited [3] with discovering the mixture known as gunpowder—saltpeter, sulphur, and charcoal—about 1248, while experimenting with somewhat similar combustible and incendiary formulas which did not have explosive qualities.[4] Bacon said, "For sounds like thunder and flashes like lightning, may be made in the air, and they may be rendered more horrible than those of Nature herself. A small quantity of matter, properly manufactured, and not larger than the human thumb, may be made to produce a horrible noise; and this may be done many ways, by which a *city* or an *army* may be destroyed,

as was the case when Gideon and his men broke their *pitchers* [Bacon's italics] and exhibited their lamps, fire issuing out of them with great force and noise, destroying an infinite number of the army of the Midianites." [5]

There is no evidence that Bacon proposed the use of gunpowder as a propellant; this seems to have been first described scientifically in Europe about 1320,[6] by the German monk Berthold Schwartz.[7] By that date, however, cannon had been listed in inventories of several European cities and states.

The development of black powder may be divided roughly into three periods: 1250 to 1450, 1450 to 1700, and 1700 to about 1886, when the introduction of smokeless powder ended its long career. The first powder made was ground and mixed by hand in small batches (fig. 5). With acceptance for military purposes in the fourteenth century came the need for production on a larger scale. As first used in firearms, gunpowder was known as serpentine; it was all of fine grain but varied widely in composition. This first form was simply a physical mixture of the finely ground ingredients; being of different specific gravities they shook down and separated when transported and had to be remixed before use. If packed too tightly this powder would not ignite. Contemporary instructions cautioned, "Thrust the poudre home faire and softly."

Stamp mills, operated by waterpower, were in use from an early date; one was operating at Augsburg, Germany, in 1340.[8] Such a mill is shown in figure 6. These mills consisted essentially of wooden beams about 4 inches square shod with bronze at the lower end; a simple mechanism raised them; then they fell by gravity. These ground and mixed the materials in a row of bowls hollowed out of an oak log. The bowls were charged with about 20 pounds of mixture, moistened with water, urine, or vinegar. The resulting cake was then pulverized, providing a well-integrated mixture. It was found that if the cake were broken into small fragments the burning rate varied with their size and ignition was more certain. The size first used was that of a grain or corn of wheat, but soon different sizes were used for pistol, musket, or cannon. The powder cake was broken up while still slightly moist, and the pieces were forced through holes in a stretched hide. The grains resulting were then passed over a horsehair sieve to remove the fine particles which were reprocessed. These grains were known as "corn" powder to distinguish them from the earlier form of "meal" powder, which was retained in use only for priming and for pyrotechnics.

Between 1450 and 1700 both composition and grain size varied.

FIG. 5.—Manufacture of powder in the 17th century. (Travaux de Mars, Paris, 1685.)

Different formulas and sizes were used for the various types of weapons, according to the strength of each. About 1540 it was observed that the coarser-grained powder was better suited to cannon, because it developed lower pressure during combustion.

By 1700 the mixing time had been increased from 6 to 24 hours, thus improving the incorporation of the ingredients. Changes in the process of manufacturing gunpowder were few and infrequent, as tradition has always played a prominent part in the industry. During the eighteenth century screw presses were introduced to increase the powder density. The resulting "cake" was broken by hand, then "corned" (granulated), dried, and "dusted." Dusting applied a thin coating of "mealed" (finely ground) powder, which reduced friction in loading and helped preserve the grains by making them more moisture resistant. From 1700 to 1886 the composition was rather well standardized (see table 1); the size of the grain alone varied.[9] During this period most powders were relatively effective, the proportions of their ingredients approaching the ideal under the yet to be expounded atomic theory.[10]

During their Revolution of the 1790's the French introduced the drum or barrel system of powder manufacture. Here the materials were ground separately in revolving iron drums by the impact of free-rolling bronze balls, then combined in a copper drum. Corning was performed in a perforated wooden drum. Mills built on this general principle were in use in the United States until the end of the nineteenth century.

During most of the early history of the United States there were two general classes of small-arms ammunition, fixed and loose. Fixed ammunition was that in which the powder charge or the charge and ball were wrapped in a paper container. This type was ordinarily supplied for smooth-bore muskets. At first the priming was of a finer-grained powder than the propellant and was carried in a small horn. Later the basic charge of large-grained powder was increased by eight to ten grains, this extra amount to be used for priming.

Loose ammunition included powder, carried in a flask or horn, and balls, carried in a pouch along with patches, if used. Also included in this category as military stores were the imported ingredients of powder—sulphur and saltpeter—and pig lead. Loose ammunition was issued for rifles and for nonstandard smooth-bore arms.

From the date of the first settlement in the United States the question of a powder supply was ever a critical one. Since for many years thereafter no known deposits of saltpeter existed in the Colonies, it became necessary to establish "nitriaries," or saltpeter sheds, in which

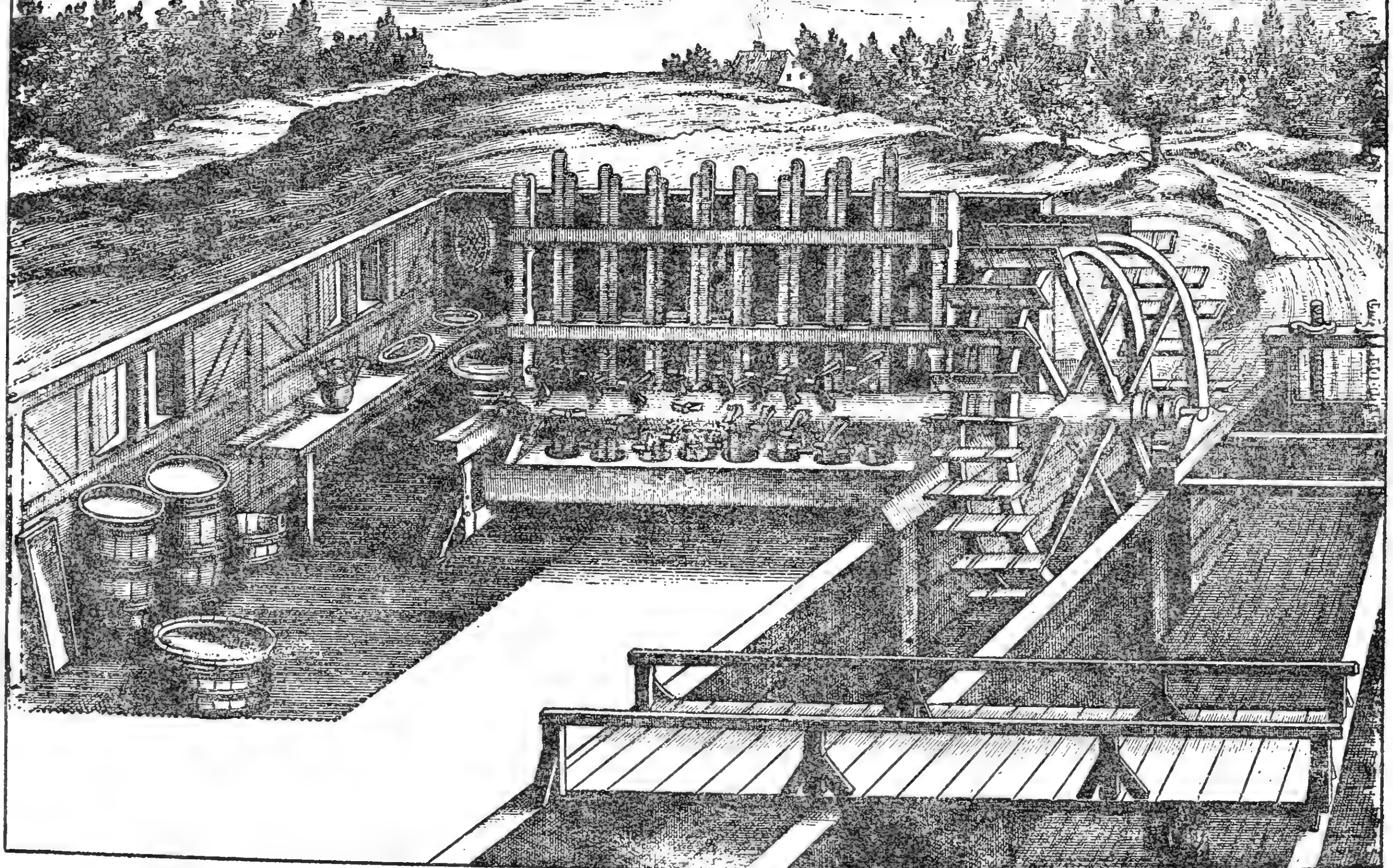

FIG. 6.—Details of water-power stamp mill. (Geschutz Feuerwerck, Casimir Simienowicz, Frankfurt, 1676.)

vegetable and animal refuse was collected and mixed with lime and water. When decomposition was complete the heaps were leached with water, and saltpeter crystalized from the liquor obtained as shown in figure 7. In 1675, the first powder mill in the United States was established at Milton, Mass.[11]

Before and during the Revolutionary War saltpeter presented a most serious supply problem. The New York Committee of Safety published a pamphlet[12] in which the manufacture of this chemical was described and encouraged. After detailing the necessary steps in the process, an attempt was made to make it seem attractive by adding the note, "Country Gentlemen (exclusive of the public good) will find an agreeable and profitable amusement in erecting works of this kind."

The method given in the same publication for making gunpowder required the proportions: Saltpeter, 75.2; sulphur, 11.3; and charcoal, 13.5 percent.

During the war all the provinces but Delaware took action to encourage the manufacture of gunpowder, and numerous mills were established, yet it still remained necessary to import large quantities of this precious substance.[13]

During this period most of the saltpeter imported found its way into gunpowder, producing about 700,000 additional pounds. If this estimate is correct, the total powder available can be summarized as follows (in pounds):

On hand at start of war	80,000
Made from home products	115,000
Made from imported saltpeter	700,000
Imported	1,454,210
Total	2,349,210

Thus, about a third of the powder available was produced in the United States, but less than 10 percent of the total supply would have been accessible without the aid of French shipping. Though powder procurement was a major problem throughout the war period, manufacture was sufficiently well organized toward its end to meet nearly all domestic peacetime requirements.

A report to the Committee of Safety of Pennsylvania, dated June 3, 1776, outlines the progress made on powder mills authorized by the Continental Congress and gives a good description of the type mill in use:[14]

SIR: Agreeable to your directions, I have been around to the Powder mills as mentioned in the list delivered to me, and find them in the following State, viz:

Doctor Robert Harris's on Cromb Creek, about three miles from Chester,

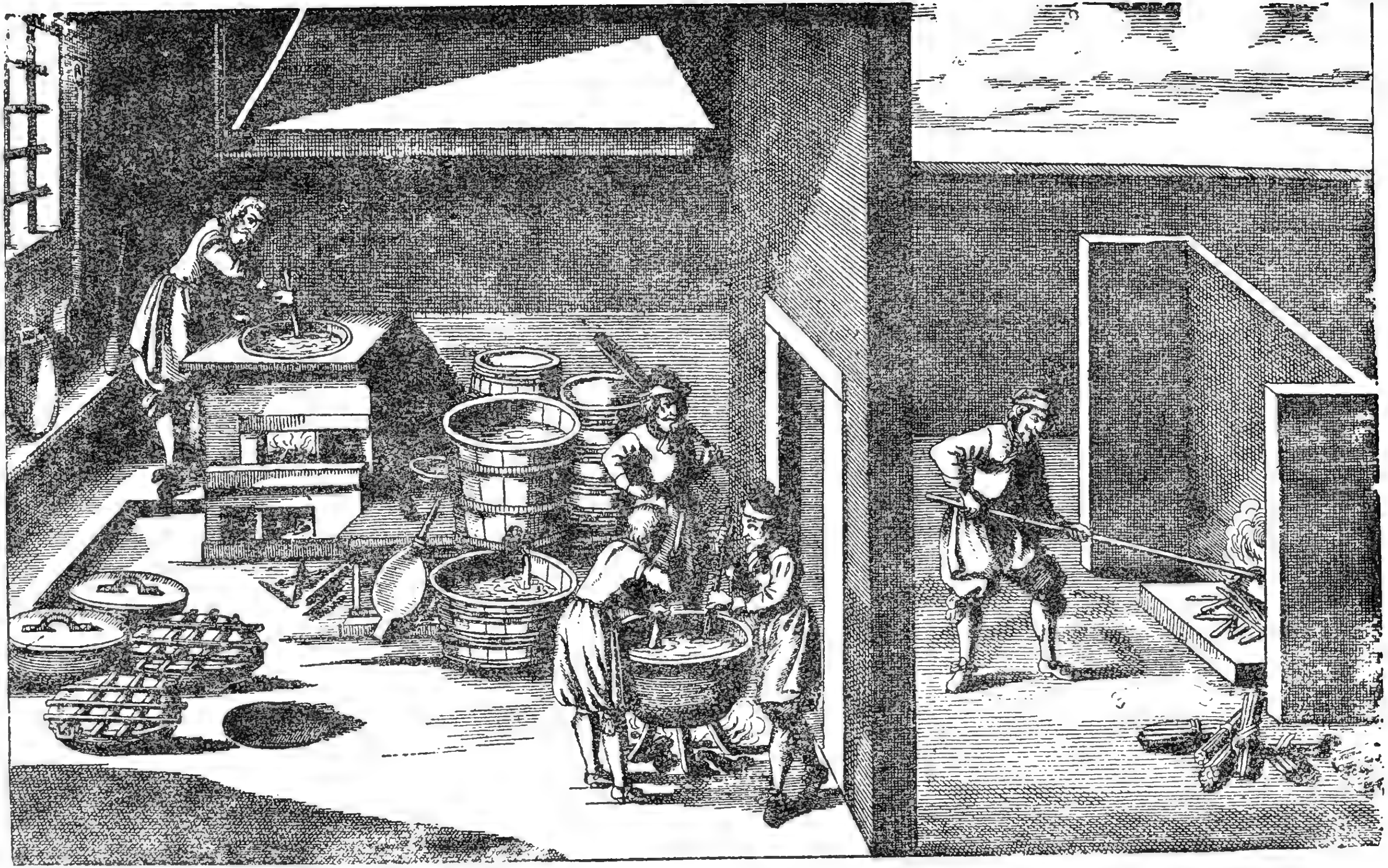

FIG. 7.—Purifying saltpeter, 15th century. (Simienowicz.)

TABLE 1.—*Composition of Gunpowder in Various Countries*[1]

Year	Country	Saltpeter	Sulphur	Charcoal (percent)
1250	England	41.2	29.4	29.4
1338	France	50.0	25.0	25.0
1350	England	66.6	22.3	11.1
1560	England	50.0	33.3	16.7
1595	Sweden	66.6	16.7	16.7
1608	Germany	52.2	26.1	21.7
1647	Denmark	68.3	23.2	8.5
1650	France	75.6	13.6	10.8
1670	England	71.4	14.3	14.3
1697	Sweden	73.0	17.0	10.0
1742	England	75.0	12.5	12.5
1776	United States	75.2	11.3	13.5 (military)
1810	England	75.0	10.0	15.0
1810	France	75.0	9.5	15.5
1810	United States	75.0	9.0	16.0
1810	Sweden	75.0	9.0	16.0
1810	Poland	80.0	8.0	12.0
1810	Italy	76.5	11.5	11.5
1810	Russia	70.0	11.5	18.5
1860	Austria	75.5	11.3	13.2 (military)
1860	China	75.7	9.9	14.4
1860	England	76.5	9.0	14.5 (military)
1860	England	74.6	11.9	13.5 (sporting)
1860	France	75.5	11.3	13.2 (military)
1860	Prussia	73.7	10.7	15.6
1860	Russia	80.0	8.7	11.3
1860	Spain	75.5	11.3	13.2
1860	Sweden	76.5	10.5	13.0
1860	United States	75.0	12.5	12.5 (cannon)
1860	United States	76.0	14.0	10.0 (military)

[1] From Hime, 1904; Busk, 1860; Deane, 1810; and Van Gelder and Schlatter, 1927.

TABLE 2.—*Imports of Gunpowder and Saltpeter during the American Revolution*

Province Importing	Pounds Saltpeter	Pounds Powder
Massachusetts	21,750	193,980
New Hampshire	.....	138,200
Connecticut	41,500	90,480
Rhode Island	.....	48,000
New York	.....	53,300
New Jersey	48,000	56,000
Pennsylvania	394,000	604,975
Maryland	.....	170,725
Virginia	.....	62,000
North Carolina	.....	12,845
South Carolina	.....	23,705
Totals	478,250	1,454,210

began Work about the 23rd ult. The Dimensions of the Mill House, 30 ft. by 20 ft., Head of Water about 2½ ft., Fall about 6 ft., Water Wheel 12 ft.

The Shaft that Works (eighty Stampers of 2¾ by 3¾ Inches, and eleven ft. Length) is thirty-two ft. long, five Mortars made of Two Inch Plank, about five foot each, one Stamper and Mortar for preparing Sulphur.

Drying House 20 ft. by 15 ft. neither floor'd nor plastered. He has received one Ton of Salt Petre and five Hundred wt. of Sulphur, or thereabouts, expected to deliver one Ton of Powder on the first Inst., and the same Quantity Weekly.

The Sides of the Mill House, and the Gable Ends of that and the Drying House being enclosed with boards not sufficiently seasoned, are very open and must have a bad effect on the Powder, yet the Doctor is of a different opinion. . . .

Other mills were inspected as follows: "On French Creek, about four miles above Moore Hall, Messrs. Cowperswaite and Biddle Proprietors . . . Capacity two Tons per Week . . . above the last, Thomas Heinberger Proprietor, capacity ½ Ton per week . . . Lower Milford Township, Bucks County, on Swamp Creek, Henry Huber, Proprietor . . . capacity indefinite."

Another document indicates that sabotage was an ever-present thought in the period as well as during later wars:[15]

French Creek, March 10, 1777.

SIR: I am sorry to inform you of the unhappy Explotion of Blowing up the Continel Powder Mill this Morning About 10 A clock, Which Wee are very suspities has been Don by Mr. Peck or his Men, as they have youfed Several odd Expressions, and they had Gon Sum Distants from it at the Time it Hapned and Runn to the next neighbors house and Did not come back till Wee Sent a Gard for them.

Mr. Peck Seem to Say at first, that all his Men Where Killed; Secondly he Said that he had Seen the Men Going to the Graining House; That & Sum other Resons Give me Som Reson to think have Sum Knowledge of it. The first Day of the instand, Col. Peter Grubb Was at the Powder Mill, Sumwhat in Drink; he Damned the Powder Mill, and told Col. Dewese Let us Blow it to Hell, Which I though Was a very odd Expression when Col. Dewese told me; and Several others heard him use the Exprestion; We have Got the Men and Mr. Peck under Gard, till firther orders from the Counsyl. So I remain

Your Friend & Humble Servant
PETER DE HAVEN

To Col. JOHN BULL or the Hon'ble
Council of Safety, Philadelphia
By favour CAPT. BODLY.

About 1800 the powder industry began to assume national importance. Most mills were small—a ton a week was considered large capacity. The 1810 census lists over 200 mills in 16 States; the largest produced 125 tons of powder annually.

Maryland was first in total production: Nearly all her output came from three mills near Baltimore. The most important of these was the

Bellona Powder Mills (later Laflin & Rand), owned by James Batty (later spelled Beatty). Other Baltimore firms were the Aetna Gunpowder Co. and the Baltimore Gunpowder Manufacturing Co.

Pennsylvania was second in production, followed by Delaware, where E. Irené duPont de Nemours had started in business on the Brandywine, near Wilmington (pl. 6). By 1804 his powder, in packages impressed with the figure of an eagle, was already celebrated for its excellence. Early in that year Dupont patented a machine for granulating gunpowder. In a poem, "The Foresters," written during his pedestrian tour in America in 1804, Alexander Wilson, the Scottish ornithologist, speaks of the woodsman in the wilds of Pennsylvania, admiring his powder. He said it left no stain on paper when burned.

> From foaming Brandywine's rough shores it came,
> To sportsmen dear its merits and its name;
> Dupont's best Eagle, matchless for its power,
> Strong, swift and fatal as the bird it bore.

In about 1809 a large gunpowder mill was established near Richmond, Va., by Brown, Page, & Co. James Tweddel had a powder manufactory on the Brandywine at that time, and Schott and Mandeville were manufacturers, near Frankford, Pa.[16]

During the War of 1812 saltpeter was obtained from deposits in limestone caves, Kentucky alone producing over 400,000 pounds. Manufacture was still carried out in stamp and barrel mills; improvements were limited mainly to purification of the ingredients. In 1812 the Schaghticoke Powder Mills were built, at the request of President Madison, at Schaghticoke, N. Y. He was concerned lest the British invade the eastern seaboard, where most powder manufacture was concentrated.

Considerable information on powder during that war is contained in an official document, parts of which follows:[17]

Date	Contractor's Name	Quantity	Description of Powder	Price	Duration
1812					
Oct. 9	E. I. Dupont De N. & Co.	200,000	Cannon & Mus.	58/100	12 Mo.
Oct. 10	Whelen & Rogers	200,000	" " "	"	"
Nov. 26	George Beidlemen & Co.	62,000	" " "	60/100	"
1813					
Feb. 26	E. I. Dupont De N. & Co.	500,000	$\frac{3}{4}$ Can. $\frac{1}{4}$ Mus.	56/100	18 Mo.
Mar. 1	Whelen & Rogers	500,000	" " " "	"	"

1815			
Feb. 4....Randolph Ross (Richmond)	200,000	Total Contract	$110,000.
Feb. 15....Charles Munns & McClean	6,000	" "	3,600.

CALLENDER IRVINE,
Com'y General

The extensive Orange Powder Works of Daniel Rogers, near Newburgh, N. Y., went into operation about 1815, and were capable of making 250,000 to 500,000 pounds of powder annually. The plant occupied 27 buildings in the various operations.[18]

In 1818, gunpowder was being made at Chelmsford (Lowell), Mass., by Moses Hale. Four years later the mills of Tileston, Whipple, and Hale were on a large scale, with a stamping mill of 40 pestles, capable of making 3,000 to 4,000 25-pound casks per year. Their product was known as "Boston Gunpowder." [19]

For about 20 years following the War of 1812 the Army was small and the large stocks of powder and ammunition in storage provided all that was needed, though it was over-age. Prior to 1836 gunpowder was considered unfit for musket-ball-cartridge ammunition if more than three years old, or even for blank cartridges after five years. Fine-grained powder of that age was classified as cannon powder for artillery blank exercise. Finally, large quantities of powder were condemned as unserviceable and either destroyed or returned to the mill for extraction of the saltpeter.

After installing a better system of manufacture, it was thought that powder would "last good and serviceable for fifty years if properly stored." The basis of the improvement in the process was purification of the saltpeter to eliminate the hygroscopic (moisture attracting) salts usually present. Pressed or glazed powder was much more stable in storage than that made from mill cake.

From 1822 to 1835 no small-arms ammunition or powder was made or purchased by the Ordnance Department. (Indeed, 100 years could be added to these dates without materially changing the truth of the statement.) Deterioration and reduction of stocks finally caused some concern and Congress ordered a complete inventory of Ordnance stores.[20] Extracts from this report follow:

INVENTORY OF UNITED STATES ORDNANCE STORES AT END OF 1834

Serviceable

Flint: Musket, 115,132; Rifle, 18,671; Pistol, 565

Powder (lb.): Musket, 11,498; Rifle, 4,174; Mealed, 127; Refined Nitre, 111¼;

Pulverized Brimstone, 143¾
Bullets (lb.): Musket, 47,115¼; Rifle, 594; Buckshot, 987
Cartridges: Musket Ball, 660,404; do. Blank, 140,916; do. Buck, 11,156; do. Buck & Ball, 73,571; Rifle, 25,085; Pistol, 45,940; Carbine, 9,600
Paper, Musket Cartridge (lb.): 654

Unserviceable
Rifle Powder (lb.): 9¼
Cartridges: Musket Ball, 65,874; Rifle, 6,750; Wall Piece, 508; Blank, 9,576; Cartridge Paper, 25 lb.
Musket Bullets (lb.): 44

The supplies on hand were considered dangerously low, and so in 1837 and 1838 orders for powder were placed with several mills and steps were taken to provide better powder-testing facilities.

Powder had been tested, at first, by firing balls into a series of wooden boards and observing the penetration. On August 28, 1776, Congress passed a resolution requiring that "gunpowder be approved by public inspectors as to its quickness in firing, strength, dryness, and other necessary qualities. Mark each keg approved with the letters U.S.A." [21] Later, various spring-restrained testers were developed, and finally the *mortier éprouvette* came into general use. With this, a fixed charge was fired in a special mortar at a fixed angle; the distance that the standard projectile was thrown gave a measure of the relative strength of the powder used. The Ordnance Regulations of 1839 give detailed instructions for testing and inspecting powder:

Art. 125. Inspection of Gunpowder. Gunpowder is ordinarilly packed in barrels containing one hundred pounds. The magazines in which it is kept shall be frequently aired in dry weather.

Art. 126. Gunpowder in the magazines giving a proof range by the established eprouvette, less than one hundred and eighty yards, shall not be used in the *service charges;* but shall be separated from that of higher range, and be legibly marked; to be used for firing salutes and for blank cartridge practice. That which gives a range less than one hundred and fifty yards shall be considered unserviceable.

Art. 127. All gun powder before being received for the United States shall be subjected to inspection and proof by an ordnance officer; the powder shall be free from dust, the grains firm, and when fired in small quantities (say about ten grains) on a copper plate, shall leave no spots or foulness. Each cask shall be tried, with two charges by the established eprouvette; when the variation in the range exceeds twenty yards, a third charge shall be resorted to, and if the medium range of any one cask be less than *two hundred and twenty five* yards it shall be rejected. The medium range of the whole quantity, received at any one time, shall be at least *two hundred and fifty yards.*

Art. 128. The inspecting officer shall cause each cask to be marked in the following manner, viz. on one end the place and year of fabrication, and de-

scription of powder; on the other end the proof-range and date of proof, taking care to leave space for dates of subsequent proofs. . . .

Art. 130. Standard powder for the reception proof of all kinds of firearms, whether manufactured at the National Armories, foundries, or by contract, shall be of such quality as to give a range of not less than *two hundred and fifty* yards by the regulation eprouvette.

This mode of testing powder was not accurate, as there were too many variable factors involved. In the 1830's the Ordnance Department procured 17 new identical éprouvette mortars. When these were tested, with the standard 25-pound ball and 1-ounce charges of powder taken from a single lot, each gave a different range. The distance to which the ball was thrown varied from 274 to 312 yards.[22]

Years before, in 1742, Benjamin Robbins had made the first scientific approach to the problem of powder testing, when he invented the ballistic pendulum. In 1839, in the search for a more accurate basis for measuring powder strength, Ordnance proposed the construction of one of these devices for use in experiments essential to the advancement of the science of gunnery as well as to test gunpowder. Work on such a pendulum was begun in 1842, at the Washington Arsenal, on the plan of those erected some time before at Metz, France. E. I. Dupont & Co., of Delaware, had obtained for Ordnance a description of this French installation, with drawings.[23]

During 1843 and 1844 powders in use in the service were tested at Washington.[24] The results obtained were highly significant, as this was a period of transition in United States small arms:

No. 1. Musket and rifle powder made in 1837, by Dupont's mills near Wilmington, Del., had a composition of 76 parts saltpeter, 14 charcoal, and 10 sulphur. The manufacturing process involved 3 hours in a dust barrel and 1 hour under heavy rollers, running on a charge of 50 pounds. The powder was not pressed, but it was glazed.

No. 2. Powder made in 1837, by Garesché, at Eden Park, near Wilmington, had a composition of 76 percent saltpeter, 13.7 charcoal, and 10.3 sulphur. This was mixed in dust barrels, incorporated with light rollers, pressed, and glazed.

No. 3. Powder made in 1837, by Loomises, Hazard, & Co., Enfield, Conn., had a composition of 76-15-9. It was processed under heavy rollers for 16 hours, running on a charge of 300 pounds. Part of the cake was pressed and the final product was glazed.

No. 4. Powder made in 1837, by Masters, Swift, & Co., Schaghticoke, N. Y., had a composition of 75-15-10. The process involved 48 hours in rolling barrels, with a 200-pound charge. It was then pressed and glazed.

No. 5. Dupont's made a special powder of their usual composition, for these tests. This was processed in dust barrels for 4 hours 45 minutes under heavy rollers, then 6 hours in a pounding mill. It was then pressed very hard and glazed. Grains when broken fractured in the manner of a piece of slate.

Products of other American mills making cannon powders were tested. These were: Sumaneytown, Pa.; Bussard's Mills, near Washington, which operated around 1824 to 1828; and some old, soft, unglazed powder, made during the War of 1812. Samples of British powder captured in 1813 and of a similar type produced in 1839 were tried. Both were from the Waltham Abbey Mill, England. A soft, unglazed and unpressed French powder was also tested.

Powder No. 5 (Dupont's) represented the exact opposite of the French powder, having extreme hardness and density of grain, while the latter was very light and soft. The tests indicated that the best domestic product was Dupont's (No. 1). The most satisfactory manufacturing process involved the use of cylinder mills and heavy rollers. The essential operations were: Separate pulverization of the materials, their incorporation by the cylinder mills alone, and formation into thick cakes under moderate pressure. Chlorides in the saltpeter varied from 1 part in 141 (No. 4) to 1 in 41,000 (No. 1). Products of mills other than Dupont's had at least ten times as much of this impurity. These tests determined that while the highest velocity with low-density powder was obtained with large grains, the opposite was the case with dense powders.

During the Mexican War, though saltpeter was produced from deposits in the limestone caves of Virginia, Georgia, Tennessee, and Kentucky, nearly all that used in the United States came from India. The nitrous earth of that country yielded about one-fifth of its weight in saltpeter, while caves in the United States produced only about 10 pounds per bushel of earth. Artificial nitre beds yielded annually, at best, only about one-fourth pound per bushel. As the war requirements were not excessive, the cheaper imported saltpeter was used for most powder production.

In the 3-year period ending June 30, 1849, the Government purchased 978,354 pounds of musket and rifle powder, 458,666 pounds of saltpeter, and 100,000 pounds of sulphur. It was noted that with this purchase of raw materials there existed in storage enough to make 45,000 barrels (4,500,000 pounds) of powder.[25]

Actual tests of Mexican War period powder showed it considerably better than the specifications. Cannon powder gave éprouvette ranges of from 280 to 300 yards, and small-grained powder 300 to 320 yards.

Musket and rifle powder was much coarser grained than the specifications, as the following figures indicate:

TESTS OF MEXICAN WAR POWDER

Type Powder	Number of Grains in Ten Grains Troy	
	By Actual Count	By Specifications
Cannon	150	150
Musket	1,100	2,000 to 2,500
Rifle	6,000	12,000 to 15,000
Sporting	73,000	......

When the Civil War commenced most powder manufacture was concentrated in the North. Confederate ordnance officials realized the importance of the problem and took immediate steps to establish powder mills and secure a satisfactory supply of the essential raw materials. The Confederate "Nitre and Mining Bureau" obtained saltpeter from caves and undertook an extensive program to produce nitrate from waste materials, neglecting no obvious sources. The Bureau's activities were the theme of a number of ribald poems composed in both South and North during the war.

The principal Confederate mill was built at Augusta, Ga. Others were in operation at Nashville (the Sycamore Powder Mills) and Manchester, Tenn.; New Orleans, La.; Marshall, Tex.; and Petersburg, Va. The last was moved successively to Columbia, S. C.; Richmond, Va.; and Raleigh, N. C. The product of the Augusta mills was considered of excellent quality; 2,750,000 pounds of powder were made there during the war.[26]

During the same period the supply of saltpeter in the North was limited. Importation from the normal source of supply—the East Indies—was complicated and expensive. It came via Great Britain, where deflation of United States currency—the pound was quoted at $13—did not help a situation already difficult. In 1863 the shortage was alleviated by conversion of Chilean nitrate of soda.

The principal mills in the North are listed in the following official correspondence.

Frankford Arsenal,
Bridesburg, Pa.
January 2, 1864.

General: I have the honor to transmit, hereto annexed, the report called for by your letter of the 31st ultimo on the subject of powder mills, requiring the name, location, and capacity of each.

Respectfully, your obedient servant,
T. T. S. Laidley

General G. D. Ramsey, Brevet Major
Chief of Ordnance, Washington, D. C.

Name and location of different powder mills and their capacity for furnishing powder. (Kind of mill: Wheel mill.)

TABLE 3.—U. S. Powder Mills in 1864

Name of Mill	Owners and Agents	Location	Name of Nearest Arsenal	Capacity in Bbls. Per Day	Quality Supplied
Buckfield Mills	J. C. Marble	Near Paris, Me.	Kennebec	6	None recommended
Camden Mills	J. C. Marble	Camden, Me.	Kennebec	6	None recommended
Oriental Powder Company	U. H. Jackson, president	South Windham, Me.	Kennebec	65	Very good
Union Powder Works	John Bickford, agent	New Durham, N. H.	Watertown	16	Good
American Powder Company	Nathan Pratt, agent	South Acton, Mass.	Watertown	10	Inferior
Massachusetts Powder Company	Fay, Potter and Tolman	Barre, Mass.	Watertown	16	Good
Hazard Powder Company	A. G. Hazard and Company	Hazardville, Conn.	Watertown	125	Good
Empire Powder Mills	Quackenbush, Steere and Armstrong	Fairhaven, Vt.	Champlain	7	Inferior
Bennington Powder Company	A. G. Geer, agent	Bennington, Vt.	Watervliet	15	Some good, some inferior
Schaghticoke Powder Company	Bliss, Greeley and Marston	Schaghticoke, N. Y.	Watervliet	36	Much that was inferior
Empire Powder Company	Smith and Rand	Kingston, N. Y.	Watervliet	15	None recommended
....	Smith and Larkin	Near Saugerties, N. Y.	Watervliet	..	None recommended
Orange Powder Company	Smith and Rand	Newburgh, N. Y.	New York	16	Some very good
Dupont's Powder Mills	E. I. Dupont and Company	Wilmington, Del.	Frankford	175	Very good
Frontier Mills	Miami Powder Company, J. U. King, president	Xenia, Ohio	Columbus	6	Inferior

NOTE.—Among several mills omitted are: The Austin Powder Company, Akron, Ohio, Daniel, Cyrus, and Linus Austin, owners; the Bellona Powder Mills, Baltimore, Maryland, Charles W. Beatty; and the California Powder Works, Santa Cruz, California.

The three largest of these mills were: Dupont's Powder Mills, the Hazard Powder Co., and the Oriental Powder Co. A brief sketch of each of these follows:

DUPONT'S POWDER MILLS

About 1804 the Duponts established a powder business near Wilmington, Del., where they introduced the latest French methods of manufacture with special emphasis on purity of ingredients. During the War of 1812 they held several contracts with the Government, while in the course of the Mexican War their mills reached a production rate of over 10,000 pounds of powder a day, on a 24-hour schedule. In 1848 they made over 400,000 pounds.

During the Crimean War large sales were made to both England and Russia. The firm expanded and at the time of the Civil War, had five complete plants—four on the Brandywine and one in Luzerne County, Pa.—with a combined daily capacity of 17,500 pounds of military powder.[27] Plate 7 gives a good idea of the appearance of a typical powder mill of that date.

HAZARD POWDER COMPANY

In 1843 the Hazard Powder Co. was organized when Col. Augustus G. Hazard bought into the original firm. This had been established under the name Loomis & Denslow at what later became Hazardville, Conn. During the transition the firm was known as Loomises, Hazard & Co. During the Crimean War the company furnished 10,000 barrels of powder to the British, and when the Civil War began it was a large concern, with a plant over a mile in length and half a mile in breadth. Hazard supplied great quantities of powder to the Union forces, though during 1862 production was delayed for three months by a serious explosion involving over 150 tons of powder. During this period, the company made over a million dollars worth of powder annually, at a rate of 12,500 pounds per day.[28]

ORIENTAL POWDER COMPANY

Shortly before the Civil War this company was known as the Gorham Powder Manufactory. Located at South Windham, Maine, the Oriental Powder Co. produced powder for the Union at a rate of 6,500 pounds per day.[29]

The various manufacturers of sporting gunpowder packaged their product in tin cans holding from one-fourth to one pound. In many

instances such cans were made in a shape convenient for use as a powder flask. Several such powder containers are shown on plate 8.

During the Civil War the following quantities of powder were purchased by the United States Government: [30]

Type	Pounds	Cost
Cannon powder	9,540,603	$2,323,527.49
Mortar powder	7,428,142	1,923,675.63
Musket and rifle powder	8,834,551	2,202,075.32
Mealed powder	358,829	80,207.80
All other types	259,940	73,017.15
Totals	26,422,065	$6,602,503.39

A typical Government order for powder was that given to John E. Bickford, agent for the Union Powder Works at Dover, N. H.

ORDNANCE OFFICE, Washington, August 24, 1861

SIR: Please to furnish this department with seven hundred (700) barrels of cannon powder, and three hundred (300) barrels of musket powder. The cannon powder should be of the kind known as No. 5 grain, samples of which will be sent to you as soon as they can be prepared. The density should be at least 1.75; and the price will be 18 cents per pound, delivered at Watertown, Massachusetts arsenal, unless otherwise directed.

It should be packed in white-oak barrels, covered with hickory or cedar hoops, divested of bark. Each barrel should contain 100 pounds. It will be inspected, as far as practicable, according to the rules laid down in the Ordnance Manual.

Respectfully, your obedient servant
JAS. W. RIPLEY
Brevet Brigadier General

The earliest American records show that gunpowder was ever one of the most important articles of commerce. In colonial times, scarcity, and control over its sale, coupled with the great demand, caused the price—or barter value—to be extremely high. It is recorded that in 1650 the Indians would pay the equivalent of $43 a pound for powder.[31] The price paid in Europe during that period was $1.26.[32]

In succeeding years the price trend was downward, except during periods of war. In 1804 imported and domestic powder cost 40 cents a pound; by 1806 it was reduced to 36 cents. During the War of 1812, it went from 44 to 58, 60, and 72 cents. By 1832 prices were down to 16 and 20 cents for blasting and sporting grades.[33]

The average price of all powder purchased during the Civil War by the United States Government was 24½ cents a pound.[34]

When the first European colonists came to what is now the United States, the making of gunpowder was already becoming somewhat standardized. Further improvements were yet to come, but the great

emphasis had shifted from obtaining a reliable propellant to perfecting firearms. During the next 150 years the rifle reached a high level of performance, though flintlock ignition and military muskets in general were little changed.

NOTES

(See Bibliography for full literature citations.)

1. Hime, H. W. L., Gunpowder and ammunition. Hereafter cited as Hime.
2. *Ibid.*
3. Gunpowder probably came to Europe through Spain, where Bacon visited. There is a treatise on gunpowder in the Escorial collection, written in 1249. (Caseri, Bibl. Arab. Hispan., vol. 2.)
4. Hime.
5. Bacon, Roger, Epistles of the secrets of arts, Ch. 6.
6. Greener, 1858.
7. His name was Berthold Anklitzen; he was called "Berthold the Black" (Schwartz).
8. Barthelot, Revue des Deux Mondes, Aug. 15, 1891, p. 817, as quoted by Hime.
9. There were exceptions, such as blasting powder.
10. Hist. Expl. Ind.
11. *Ibid.*
12. Essays upon the making of salt-petre and gunpowder, printed by Samuel Loudon, New York, 1776.
13. Stephenson, O. W. Supply of gunpowder in 1776.
14. Pennsylvania Archives, 1st ser. IV.
15. Pennsylvania Archives, 1st ser. V.
16. Census, Report of manufactures, Washington, 1810.
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18. Bishop, History of American manufactures, vol. 2, Philadelphia, 1868. Hereafter cited as Hist. Amer. Mfr.
19. *Ibid.*
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22. House Doc. 186, 24th Congress, 2d Session, 1837.
23. Senate Doc. 229, 26th Congress, 2d Session, 1841.
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26. Ord. Rep., vol. 4, p. 992.
27. Hist. Expl. Ind.
28. Hist. Am. Mfr., vol. 3.
29. Hist. Expl. Ind.
30. Ord. Dept., Summary statement of purchases and fabrications, Jan. 1,

1861, to June 30, 1866, Ord. Office, Washington, 1866 (Appendix E). Hereafter cited as Sum. St. Purch. & Fab.

31. Netherlands: Reports of committees of the States General on the affairs of New Netherlands, 1650.

32. Proceedings of the Assembly, New Netherland, XIX, 1645.

33. Ex. Doc. 308, 22d Congress, 1st Session, Prices of gunpowder in the United States.

34. Sum. St. Purch. & Fab.

Chapter III

FIREARMS IN THE SERVICE OF THE UNITED STATES

When the first settlers came to North America they brought with them the types of weapons then in use in Europe (pl. 9a, b). From the earliest days of the colonies firearms were at a premium, and most of them came from across the water, from England, France, Sweden, Spain, and Holland. There were local gunsmiths, but they were engaged principally in the repair of arms and the rebuilding of the precious weapons damaged beyond repair, by combining parts from two or more. Those who made new guns usually imported the locks, which could be purchased in Europe for less than the manufacturing cost in America.

In most of the colonies importation of complete firearms or of ammunition was restricted by law. The object was to keep weapons out of the hands of the Indians, but that the laws were more broken than observed is indicated by a part of Governor William Bradford's account written in 1628, in which he said, "The Indians are full of pieces all over, both fauling peeces, muskets, pistols, etc. They have also their moulds to make shotte of all sorts, as musket bullets, pistol bullets, swane and gose shote and of smaller sorts; yea some have seen them have their scruplats to make scrupins."

It is usually quite difficult to identify a seventeenth- or eighteenth-century military-type firearm as made in America unless its history is positively known or its stock made of a wood typically American. Some few, indeed, were marked by their makers, but as restrictions on gunmaking discouraged this practice, these are rare pieces.

During the first half of the eighteenth century the "Pennsylvania" or "Kentucky" rifle began to appear and soon became the chosen weapon of the frontiersman, who depended upon its accuracy for both food and protection.

In 1738 Hugh Orr, a young Scotchman who had been educated as a gunsmith and locksmith, opened a shop at Bridgewater, Mass. At first he made scythes and other edge tools and implements, but in 1748 he made 500 stands of arms for the Province of Massachusetts Bay. They were deposited in Castle William and were said to have

been nearly all carried off by the British when they evacuated the town of Boston. Orr was later employed in manufacturing a number of stands of arms and was a partner in a foundry for casting cannon. The muskets made by him in 1748 are believed to be the first official military arms made in this country. His son, Robert Orr, was later (1804) master armorer at Springfield Armory. Hugh Orr died in 1798, at the age of 82.[1]

As early as 1740 gun manufacture was carried on in Albany, N. Y. Gun stocks were then made by Vander Poel, proprietor of a sawmill on Beavers Creek. Muskets and rifles were made in considerable quantity in Albany for the Indian trade, of which the town was a principal center. The stocks were of wild cherry, red maple, and occasionally black walnut from Pennsylvania. The armorers at Albany were employed by the Government during the Revolutionary War.[2]

At the start of the war the only military arms of any consequence in the hands of the colonists were the muskets left from the earlier wars with the French and Indians (pl. 9c). Of these, the British "Brown Bess" musket [3] varied considerably in caliber, 0.75 to 0.80, whereas the French muskets, often called the "Charleville" from the name of one of their manufacturing arsenals (analagous to Springfield) stamped on the lockplate, were caliber 0.69 or 0.70. At first the British caliber predominated; in 1775 Congress prescribed that the bore of the service musket be three-fourths of an inch. Later, however, as French arms became available in larger quantities, the corresponding caliber 0.69 was adopted.[4] During the war anything that would shoot was pressed into service, and consequently a great variety of fowling pieces and muskets of varying ages was used. The business of procuring arms and ammunition was conducted by a "Secret Committee" of Congress and by the "Board of War." The committee at first consisted of six men, "Messrs. Washington, Schuyler, Mifflin, Deane, Morris, and S. Adams." In 1776, Mr. W. Livingston was added, and later, the committee had nine members, including Franklin and others.[5] In September 1775 Congress empowered the Secret Committee to contract for the importation of "10,000 stands of arms and 20,000 good plain double bridle musket locks . . ." [6]

On November 4, 1775, Congress recommended to the several assemblies or conventions of the Colonies that they "set and keep their gunsmiths at work to manufacture good firelocks with bayonets; each firelock to be made with a good bridle lock, three quarters of an inch bore—barrel to be three feet eight inches in length, the bayonet to be eighteen inches in the blade, with a steel ramrod, the upper loop thereof to be trumpet-mouthed." [7] Soon thereafter it became necessary

to acquire arms wherever they could be found. Some were seized from Tories, and on January 21, 1776, an order was issued from GHQ at Cambridge requiring "the Colonel or Commanding Officer of each regiment . . . to buy up such arms as are wanted—if possible with bayonets but not to refuse good firelocks without." [8] On February 23, 1776, Congress authorized the Committees of Safety to contract for muskets and bayonets for the United States, and by May 23, 1776, a Continental firearms factory existed at Lancaster, Pa., and a gunlock factory at Trenton, N. J.[9] Sawyer (1910) lists a number of arms makers of the Colonial period (see Appendix 4).

Massachusetts.—In 1776 there was a gun factory near Sutton, on Mill Brook; and at Leicester, on the Boston Post Road, there was "a famous gunsmith, Thomas Earle, who was supposed to equal any workman in the U. States in that branch of business." [10]

Rhode Island.—In Rhode Island muskets were manufactured for several of the militia companies of the Colony as early as 1775 by Stephen Jenks, of North Providence. Small arms were at that time extensively made by several other persons in the Colony.[11]

Pennsylvania.—Small arms were made at Lancaster, Philadelphia, and elsewhere in Pennsylvania. The general insecurity of the frontier settlements, especially during the French and Indian Wars, together with the Indian trade, rendered firearms a necessity in every household, and created a steady demand for rifles and other weapons. The manufacture also received a great impulse during the Revolution, when export of military stores from England was prohibited. A letter written from Philadelphia to a member of Parliament soon after the Proclamation was received in 1774, informed him that the Act would be of no avail, as there were enough gunsmiths in the Province to make 100,000 stands of arms within a year at 28 shillings apiece, if needed, and that a manufactory of gunpowder had already been established.

In 1776 the Committee of Safety established a Provincial gunlock manufactory in Cherry Street, Philadelphia, with Peter De Haven as principal gunsmith. In November 1776 the Council fixed the price to be paid to gunsmiths for good gun barrels delivered to the lock manufactory, at 24 shillings apiece.[12] In April 1778 the factory was in operation at Hummelstown, near Harrisburg, still under De Haven, as contracting superintendent. Later that year he recommended its removal to French Creek or Philadelphia. Brass gun mountings were made by Lewis Prahl, and Lewis Birnie erected a furnace and mill for file cutting in connection with the lock factory. Contracts were let at Lancaster and York for muskets made in accordance with the

specifications of the Continental Congress; the price, with bayonet and steel ramrod, was £4 5s. (Pennsylvania currency). It was found difficult to make contracts at that price, as the gunsmiths preferred to make rifles, for which there was a lively market. Muskets were also made at Carlisle and in Bedford, where there was but one regular gunsmith.[13] There were two boring mills for gun barrels near Lancaster in 1786, and the borough contained seven gunsmiths. Washington County had three gunsmiths; one, John Kerlin, contracted to make muskets at £4 5s. each.[14]

Maryland.—Maryland, in common with the other United Colonies, gave general encouragement to arms manufacture during the disputes with Great Britain. In August 1775 a Committee of the Maryland Convention considered the establishment of arms manufacturing in the Province. The Committee decided to contract with gunsmiths for arms and reported 12 gunsmith shops in the Province, three in Baltimore, one in Georgetown, four in Fredericktown, two in Hagerstown, and one in Jerusalem. It was estimated that each could produce in one month "20 substantial muskets ([with barrels] 42 inches in length, $\frac{3}{4}$ inch clear in the bore, $\frac{1}{2}$ inch in diameter at the breech [?] and $\frac{7}{8}$ of an inch at the muzzle), with steel rammers, and bayonets 20 inches long, including the stock." They planned to have 240 muskets furnished monthly at about £5 each. There were also some gunsmiths on the Eastern Shore, and the Committee thought that the number would probably be increased by the encouragement given. Rifles were also reported available if necessary (recommended to be 3 feet 4 inches in [barrel] length and $\frac{1}{2}$-inch bore), and would cost about £5 each. Swords and tomahawks, they believed, might also be made in the province. The word "Maryland" was to be stamped on the gun barrels.[15] I. Behr's name appears on some muskets marked "Baltimore Town" and "Maryland."

Persons were accordingly appointed in Frederick and other towns to make contracts for muskets, at a price not over $10.66 each. The specifications were "good substantial proved muskets, $3\frac{1}{2}$ feet in the barrel $\frac{3}{4}$ inch bore, with good double bridle locks, black walnut or maple stocks, and plain strong brass mountings; bayonets with steel blades, 17 inches long; steel ramrods, double screws; priming wires and brushes fitted thereto, with a pair of brass moulds for every 80 muskets to cast 12 bullets on one side, and on the other to cast shot of such size as the musket will chamber three of them." The Council of Safety inserted an advertisement in the Maryland Gazette on August 31, 1775, offering liberal encouragement to any who would engage in the manufacture of firearms or erect a gunpowder mill near

Baltimore, or saltpeter works elsewhere, and inviting proposals for that purpose.

Isaac Harris was ordered to receive $\$4\frac{2}{3}$ in bills of credit for every proved musket barrel he should deliver according to a sample furnished by him.

In October, William Whetcroft, of Annapolis, was encouraged by the Council to import in the ensuing spring a sufficient number of workmen to make and deliver every week during the next two years 50 complete muskets, which the public would agree to take at £4 each, common money. In case the differences with Great Britain were brought to a close before that, he would be compensated for his expense and trouble. He was allowed to use imported locks of not less than 7 shillings each, for the first 800 stand.

In December the Convention resolved to establish a gunlock factory at Fredericktown or in its vicinity, for which £1,200 were appropriated. One dollar (7s. 6d.) was authorized to be paid for each lock.

In February 1776, Henry Hollingsworth, at Head of Elk (Elkton), Cecil County, proposed to manufacture arms and was advanced £500, to be repaid in barrels at 20 shillings each and bayonets at 8 shillings. Money was advanced at the time to Elisha Winters for 600 stand of muskets at £4 6s. each. John Yost contracted for muskets at the same price, and for rifles at £4 15s. Priming wires and brushes were made by Christopher Rabreck at Baltimore. Richard Dallam also made guns for the Province, and Robert Read, of Chestertown, sought a contract for making muskets. Samples of gunlocks were presented by one Messersmith who stated he could make ten a week, at $3 each.

In August 1776 Elisha Winters, who was making 40 muskets a month, according to contract, proposed to undertake control of the Frederick gunlock factory, which by mismanagement had accomplished little. In October this supervision of factory was transferred to Winters, but the plant appears to have remained unsuccessful, as it was sold in 1778 by an Act of the Assembly.

The principal source of gun barrels seems to have been Henry Hollingsworth. There was also a gun factory in Dorchester County, and some were made on the Eastern Shore at £4 5s. each.[16]

Virginia.—In March 1775 a committee of the Virginia Convention reported a series of resolutions designed to promote local manufacture of gunpowder, cloth, and other necessities. To provide lead for bullets the Convention in 1776 reprieved a number of convicts and sent them to work in the mines in Fincastle. For small arms Virginia seems to

have depended less on her own resources than on Maryland and some other States. In July 1775 the Convention established the Virginia Public Gun Factory at Fredericksburg to manufacture small arms for equipping the Continental Line regiments from Virginia. Production started in 1776 under Commissioners Col. Fielding Lewis and Maj. Charles Dick. Work was discontinued in 1783 and tools were transferred to the Virginia Point of Forks State Arsenal and Depot, where repair and parts manufacture continued until about 1803. Another move was then made—to the Virginia Manufactory at Richmond.

The Rappahannock Forge or Hunter Iron Works was in operation prior to the Revolution, across the Rappahannock from Falmouth. Small arms were made till 1781 when Tarleton's raid caused operations to cease.

After the peace (1786) Jefferson and Lafayette were commissioned to purchase arms in France for the Virginia Militia. Mr. Jefferson, in a letter written in August 1786 to John Jay, mentioned a valuable improvement that had just been made in the manufacture of muskets in Paris. It had been approved by the Government, which was then establishing a large manufactory to put it in execution. It consisted in "making every part of them so exactly alike that what belongs to any one may be used for any musket in the magazine." It had then been applied only to the manufacture of locks, but was soon to be extended to all parts of the gun. Jefferson recommended that this principle be considered in connection with the proposed State Manufactory for arms. This seems to be the origin of the idea later adopted by Eli Whitney, Hall, North, and others for the mass production of arms. A similar system was used by Sir Samuel Bentham in England toward the end of the eighteenth century. Bentham "classed the several operations that have place in the working of materials of every description according to the nature of the operations themselves . . ." and not according to the trades or handicrafts for which they were used.[17]

In 1797 John Clark was commissioned to build the Virginia Manufactory, a State armory, at Richmond. Construction began in 1801, with George Williamson as mastor armorer. Production began in 1802, and by 1806 muskets, bayonets, rifles, pistols, and swords were being made. Manufacture and repair were carried on until 1843.[18]

North Carolina.—On April 3, 1775, the Convention of North Carolina assembled at New Bern, appointed Commissioners for the districts of Washington, New Bern, Edenton, Halifax, Hillsborough, and Salisbury to direct establishments to manufacture "good and

sufficient muskets and bayonets." They were to collect together all available gunsmiths and likely apprentices and employ them at public expense. For each musket with bayonet, made according to the prescribed pattern, they were to be paid not to exceed £5. There is little evidence as to how far these measures were successful.[19]

Besides those muskets made on official contracts with the Committees of Safety of the various States, a few were procured by direct authority of Congress, which on January 2, 1779, resolved that a "Contract is authorized with Penet, Windel & Co. for muskets." [20] In 1777 a standard form of marking was adopted. On February 24 of that year Congress resolved "that all arms and accoutrements belonging to the United States be stamped or marked with the words *United States:* All arms already made to be stamped upon such parts as will receive the impression, and those hereafter to be manufactured to be stamped with the said words on every part composing the stand." [21]

During the war, parts of muskets of British or French origin were salvaged from the battlefield and used in making new arms, or reassembled with other used parts to make more or less hybrid weapons, some of which puzzle collectors of a later period. On February 11, 1778, Congress passed a resolution to the effect that "all Continental armourers shall be under the direction of the Board of War and Ordnance and of the Commissary-General of Military Stores . . . see that every method is taken by the armourers to hasten the repair of arms." [22]

Certain small elements of the Continental Army used rifles—usually each rifleman brought his own favorite weapon with the necessary accoutrements. These rifles had from 4 to as many as 16 grooves,[23] Though in general the rifles in service were personal arms of the civilian "Kentucky" pattern, a number were purchased by the Government. On April 9, 1777, orders were issued by Congress to the Commissary-General of Military Stores "to furnish as many rifles, not exceeding 1,000, to be sent to Fort Pitt, as he can procure . . .," and a few days later to "Colonel Flower, CGMS, . . . purchase 200 rifles and their accoutrements, to be sent to Fort Pitt." [24]

On December 30, 1776, Congress resolved "that Gen. Schuyler, or the Commander of the Northern Army, be directed to cause an elaboratory to be erected at such place as he shall judge most convenient, to fix all the necessary ammunition for the ensuing campaign." A tentative choice was made—Brookfield. On April 14, 1777, Congress resolved "that the resolution passed the 27th [30] of December

last, for erecting a magazine and laboratory in the town of Brookfield in the State of Massachusetts Bay, be repealed; And that instead thereof, a magazine sufficient to contain 10,000 stands of arms and 200 tons of gunpowder, and a laboratory adjacent thereto, be erected in Springfield in the said State."

What were probably the first really official United States muskets were assembled subsequent to 1777 at the Springfield, Mass., "Elaboratory" [25] from contract-made parts (pl. 10a). The first of these, like the first official model made at Springfield in 1795 (pl. 10b), were copied from the standard French musket, but were caliber 0.70. This was officially reduced to caliber 0.69 late in 1778. The parts were made by gunsmiths on Committee of Defense contract and sent to the Depot and Elaboratory at Springfield for assembly and proof. The finished muskets bore the eagle and "US." Many of the parts also had the contract mark "CT." The first were probably assembled at Springfield during the year 1778, when operations began. One such musket, dated 1789, was in the collection of Maj. Charles C. Foster.[25] The date was stamped across the rear end of the lock plate. Ahead of the cock was a small US below a small spread eagle. The barrel was marked near the breech with a US, CT in oval, and V. Another V was on the barrel tang. This musket was closer to the French M1777 than to the M1763 in design.

At the start there were spasmodic attempts to mark lockplates and other parts with serial numbers and US. Serial numbers were not used again until after the War of 1812.

Town records in Springfield show that in 1795, after the Springfield Armory had been authorized to manufacture arms, an inventory was taken of all arms then in storage by the inspector of arms in the Springfield area. Such as conformed to the pattern of the Model 1795 musket and were in good order were stamped by the inspector. Conforming to the practice then established of marking the date of manufacture of the new muskets on the butt plate, the old muskets of acceptable pattern but uncertain date of manufacture were then stamped with an "X" on the butt plate.

Prior to 1794 there were no recognized types of pistols; all available large-bore pistols were used—most of them of European origin. In 1776 Congress resolved "that the secret committee be directed to provide as soon as may be, arms . . . for 3,000 horse." [26] As in the case of the muskets, to be considered authentic, an "American" Revolutionary War pistol should have definite markings or documentation.

After the Revolution an attempt was made to standardize small arms. The Act of 1792, establishing the Militia, required that each

citizen enrolled supply his own musket, with ammunition to fit. Five years from the date of passage of the act, all muskets used were to be of a caliber suited to 18 balls to the pound.

In 1803 a memorial to Congress from the gun manufacturers of the borough of Lancaster, Pa., against the remission of duties upon arms manufactured in foreign countries, stated that manufactories of arms had been established there, and in other parts of the State, at much expense, and 20,000 stand were nearly completed for the Commonwealth of Pennsylvania. Mills for boring gun barrels had been erected, and the locks, and every other part, were made in the best manner. They were confident 20,000 stand of arms could be annually made in the State, and in five years, with continued protection, the business would be fully established.

During the War of 1812 the average annual expenditure of muskets from loss or other causes was 90,545 stands. For the next 30 years seven times that number was considered the minimum stock level that should be held in readiness for emergency in Army depots. In peacetime it was assumed that a musket would have a life of 12 years in the regular service or 10 years if in use by State militia.[27]

The Regulations for National Armories, published in 1816, prescribed the manner of marking muskets and bayonets. The name of the manufacturer or of the armory was to be stamped on the lockplate, behind the cock. An eagle with the letters "US" was to be stamped under the pan. The year of fabrication was to be stamped on the tang of the breech plug, and the letters "US" on the tang of the butt plate. The contractor could, if he desired, substitute his name for that of the place of manufacture. Thus we find lockplates stamped Henry, Sutton, Virginia Manufactory, Milbury, Wickham, and so forth. Herein has been the cause for a bit of confusion. For instance, some of the muskets marked Virginia Manufactory were produced under the McRae contracts. Muskets marked New Haven were made by Whitney, or Edwards and Goodrich, trustees of the Eli Whitney estate.

Under the 1816 regulations, muskets and bayonets were to be numbered in a new series for each year, the former on the barrel near the breech, the latter on the socket. There were to be 2,400 stands for each subseries. The first made each year was to be marked A, the second A1, then A2, A3, to A99. Then the letters B, C, D, etc., were run through similarly until 2,400 muskets had been marked. (The letters J and V were apparently skipped.) The second subseries for that year was formed in like manner but with the addition of a lower-

case "a" under the capital letters, thus: $\genfrac{}{}{0pt}{}{A1}{a}, \genfrac{}{}{0pt}{}{A2}{a}, \genfrac{}{}{0pt}{}{A3}{a}$ . . . The next used small "b" and so on through the alphabet a second time. Thus the combinations of letters available exceeded the total output anticipated for any one year.

Until 1842 the French-type flintlock musket, with few significant changes, continued the standard arm. During that period the barrels were shortened from about 44 to 42 inches, bayonets being increased in length correspondingly. Other minor changes involved barrel bands and springs, sights and bayonet lugs, external lock parts, stock, and finish. In 1822 a new model was officially recognized (pl. 10c) and another (pl. 10d) in 1840.[28] This last was first planned in 1835, when improved models of small arms were being considered, with reduced charges to suit the better grades of powder then becoming available. A manuscript Ordnance Regulation of 1839 refers to the "New Model 1835 Musket," but further changes were authorized and the later printed version (1840) and subsequent publications all call it the Model 1840. Only patterns of the Model 1835 were made.

The standard muskets were made at Springfield and Harpers Ferry Armories and by numerous private contractors.[29] Those made by Whitney, on his 1798 contract, were patterned after the Model 1777 French musket. From time to time a few special types were produced. Some of these, known as musketoons, simply had shorter barrels for use by artillerymen or marines. Referring to this type in 1858, Colonel Craig, then Chief of Ordnance, described them as "a short rifle, and inaccurate." During the period 1840 to 1865 practically all the Model 1840 muskets, and those of earlier dates then in first-class condition, were converted to use percussion caps.

At various times the armories made special "rifle caliber" muskets. Some of these were for use by the cadets at West Point; others were for issue to Indian tribes, in accordance with Government treaties. The "cadet" musket was a light-weight version of the standard arms, whereas the "Indian" type had a sporting stock with pin fastenings. This was cheaper to make and preferred by the Indians. The flintlock cadet musket made in 1830 incorporated several nonstandard parts, including a Damascus-twist barrel made in Belgium. Small production of these types did not justify special tooling at the Armory.

There has been some confusion about the caliber of these cadet arms. Then, as always, the Ordnance Department desired to confine the number of sizes of ammunition to a minimum. When a smaller-bore musket was desired, therefore, the ball selected was the next smaller standard size—that for the rifle, of 32 balls per pound, or

caliber 0.525. For use in the caliber 0.54 rifle, these were enclosed in a patch. To facilitate loading musket balls were always considerably smaller than the bore diameter. Prior to 1845 the standard difference in diameters of ball and bore (known as windage) was 0.050 inch.[30] Thus, a smooth-bore arm to use the caliber 0.525 rifle ball, had a bore of 0.525 plus 0.050, or 0.575 inch.

The first United States percussion musket, the Model 1842 (pl. 10e), was the last standard smooth-bore, though special models were made, as that for the Frémont expedition of 1847. Also adopted in 1847 was a series of short, caliber 0.69 musketoons, for use by cavalry, artillery, and sappers.[31]

To equip the rifle battalion authorized in 1792, Pennsylvania gunsmiths made a few rifles for the Government under contract. These were typical "Kentucky" rifles, identified only by the inspectors' marks and the "US" stamped on the barrels or lockplates. Some of the locks were made in England.[32] One of these contract rifles, made by P. Gonter, is shown in plate 11a. In 1804, when a rifle regiment was authorized, rifle manufacture started at Harpers Ferry Armory (some pattern pieces were dated 1803), continuing intermittently until 1820 (pl. 11b). A new model, introduced in 1814, was made by contract only. This resembled the Model 1804, except that it had a full-length stock, instead of the half stock of the earlier rifle, and an oval patch-box. Ordnance records in the National Archives show that on March 17, 1814, a contract for 2,000 of these was given to Henery Derringer (*sic*) and that on November 23, 1814, Robert Johnson received a contract for 2,000. Similar rifles made by S. Cogswell are known. These were probably made on a New York State contract.

The next model was that of 1819, for which patterns had been made two years earlier. This rifle, made at Harpers Ferry (patterns), and by contract with Starr, Johnson, Deringer, and North, was of a completely new design (pl. 11c) based on that of 1814. In the years following the War of 1812 most rifles that the Government issued went to State militia units or to the Indian department. In 1832, when a ranger battalion was organized, its regulations prescribed that the enlisted man should supply his own horse and rifle. The Model 1819 continued the standard rifle until 1841, though it continued in manufacture till about 1848. The first percussion model, that designated the Model 1841 (pl. 12a), was popularly (and officially by the Confederate States) known as the Mississippi rifle, as during the Mexican War one of the first units to be armed with it was a regiment of riflemen from that State, commanded by Jefferson Davis. This was the last model to use the round, patched ball.

In 1842 experiments were conducted with caliber 0.69 muskets, altered by shallow rifling to use cylindroconical bullets. In 1853 and 1854 modified Minié bullets were tried in the Model 1841 rifle.[33] Intensive tests were then made to determine the optimum caliber for a proposed new series of small arms to use this type bullet, and in 1855 it was decided to standardize the caliber 0.58. Three points were considered in selecting this caliber: (1) It was to be as small as possible to allow the soldier to carry the greatest number of cartridges; (2) not more than two types were desired, one for the musket and one for the pistol, to avoid confusion; and (3) the bullet should be large enough to give effective expansion into the grooves in firing.[34]

In 1855 the new arms, equipped with the Maynard tape primer, were adopted, including a rifle musket (pl. 12b), rifle, and pistol carbine (pl. 14j). Minié-type bullets were developed also for use in rifled, caliber 0.69 muskets and musketoons (mostly of the models of 1842), and many of the Model 1841 rifles had their barrels reamed up to the new standard caliber 0.58.[35] Variations of these arms served through the Civil War (pl. 12c, d), with no great changes, except the omission of the Maynard primer. During that war 1,472,614 Springfield rifle muskets were made (pl. 13) or purchased, and 1,168,367 rifles and muskets were imported by the United States Government. (Appendix 5.)

When the Army adopted the caliber 0.58 for all rifled arms, the Navy decided to retain the larger caliber 0.69. In 1856 Admiral Dahlgren outlined the desired characteristics for a Navy rifled musket. He considered that the lighter ammunition of the smaller caliber embodied no material advantages to the Navy, as the sailor did not have to carry his supply with him in the field as did the soldier. His recommendations were:

(1) The piece should not be lighter than the present musket in common use for the army and navy, nor its caliber materially less.

(2) This weight of arm and diameter of bore will admit of the greatest weight of ball that has been used. The present French Regulation shot weighs 733 grains—the charge 69½ grains. The English shot weighs about 520 grains, and the charge of a cartridge, carefully weighed, gave 73½ grains, though this seems to be larger than that mentioned by some writers—2¼ drs.

(3) The shot should not be very acute in front, as such form is more liable to have its apex displaced from the axis of the bore, and hence increase inaccuracy of flight,—but it should be cylindrical at the base and terminating with a conical front which ought rather to be rounded like the English than acute like the French. The latter presents less resistance to the air and to substances which it may enter, but of these abundant properties it may well spare something in order to gain more power of shock, etc. etc.

(4) The barrel should be shorter, however, than that of the U. S. smooth

bored musket, as all length that is not indispensable to accuracy is inconvenient for boat service. The French Delvigne musket has a bore about 33½ inches long, which is nearly eight inches shorter than our service musket.

(5) With a like weight and length, the barrel may be better fortified with metal about the location of the charge, than that of the common musket, and the alleged superiority of carbonized steel for gun barrels should be considered.

(6) The present bayonet, which is the most useless thing in the world except at the end of the musket, may be replaced by another, fashioned like a stout sword or bowie-knife, which will be quite as serviceable for its particular purpose and useful in many others besides.

The manner of expanding or forcing the ball, the number of grooves, depth, twist, and other details, can only be determined by experiment, as well as the actual development of the general principles which have been noted above to be most conducive to the power of the arm. Until a proper arm can be provided, a substitute may be had by rifling the present musket; and this is contemplated by the Bureau—but such an arrangement should be in force no longer than is required to decide on and obtain the proper arm.[36]

The caliber 0.69 rifle developed to meet the Navy specifications was made by Whitney and commonly known as the "Whitneyville" or "Plymouth" rifle. It was equipped with a bayonet, unique in the United States service, known as the "Dahlgren." [37]

In the United States Army the carbine was usually the firearm issued to mounted troops. Only one muzzle-loading model was made in any quantity—that of 1855. Unlike other models of that year, this was caliber 0.54 and did not incorporate the Maynard tape primer lock in its design.

Our first official pistols were caliber 0.69 (pl. 14a). This size was made during a period of about 20 years, though during that time pistols of caliber 0.54 were produced at Harpers Ferry (pl. 14b), and a number were made by private contract in 1808 (pl. 14c). Writing to the Secretary of War on June 10, 1815, Decius Wadsworth, Chief of Ordnance said, "The Caliber of the pistol, for greater simplicity, might be the same as that of the rifle. It is essentially wrong, in my opinion, to give to a pistol the caliber of a musket, which, I am informed has been done in some of those made for the United States Service. The pattern of the pistols made at Harpers Ferry I approve." On January 8, 1816, the bore was reduced to caliber 0.54 (pl. 14d) by a modification of the Simeon North contract of April 16, 1813.[38] In 1818 Springfield Armory made up some large-bore pistols, but these incorporated barrels and other parts produced several years before (pl. 14e). These pistols were of a size then no longer considered suitable for service use. As the entire production was still in store at the Springfield Armory in the late 1850's, it appears that they were never used by the Army. They were finally sold as obsolete arms.

During the next 40 years several caliber 0.54 models of different barrel lengths were made; the models of 1819 (pl. 14f) and 1836 (pl. 14g) were the principal types.[39] In 1837 a few Elgin cutlass pistols were purchased by the Navy. The last of the caliber 0.54 pistols were the percussion models of 1842 and 1843. Manufacture of the former (pl. 14h) continued by contract for some time after the official adoption of the Model 1855 pistol carbine, caliber 0.58, which was made only at Springfield (pl. 14j). Ordnance records show that during the Civil War 1,977 smooth-bore "horse pistols" were purchased. A comparatively small number of the Model 1843 "box lock" pistols (pl. 14i) were purchased in the years 1843 to 1848—mostly for the Navy.

A few muzzle-loading repeating arms of the multicharge type were purchased by the Government for use in the Service. During the Revolutionary War a man named John Bolton sold this idea to Congress, though it is not known that any of his guns were actually made. On May 3, 1777, Congress approved an order authorizing him to make or alter "100 muskets on the construction exhibited by him and called 'the new improved gun'." [40] The first of this type actually procured appear to be those made during the War of 1812 for the Committee of Defense of Philadelphia, under a patent granted March 23, 1813, to Joseph C. Chambers of West Middleton, Pa. On January 31, 1815, a contract for 100 of these rifles was given to Lewis Ghriskey of Philadelphia.[41] In a letter written in 1822 to Secretary of War John C. Calhoun, Lt. Col. George Bomford, then on Ordnance Duty, listed these as "100 patent rifles" among "purchases made under the Law of 1808, for arming the Militia." [42] In 1862, these were again mentioned in the proceedings of the Franklin Institute: "Mr. Nystrom detailed some experiments made by him in repeating Fire Arms. . . . One of the members remarked that a Mr. Chalmers (*sic*), of West Middleton, Penna., had patented a gun in 1813, on the same principle [where the barrel was filled with cartridges], which operated successfully." [43] These 5-shot rifles used a sliding lock supplied by Ketland [44] and had typical "Kentucky" stocks. The specimen illustrated (pl. 15a, c) is marked No. 51. In 1814 the Navy purchased "200 muskets and 20 swivels on Mr. Chambers' plan of gunnery" subcontracted by Chambers from Tryon & Henry of Philadelphia.[45] Pistols were also produced for the Navy—the type is illustrated in Sawyer.[46] Swivel guns were made for both Pennsylvania Militia and the Navy. The former were caliber 0.69, but the latter as well as the Navy muskets and pistols corresponded to the British calibers—0.75 for the musket ball. At the date of this writing, no specimens of these swivels are

known. From Navy correspondence in the National Archives it can be told that they had seven barrels, of musket caliber, each with multiple charges of special ammunition. It is believed that the swivels combined the Chambers sliding lock with a series of charged perforated balls. The sliding lock distributed the initial fire to each barrel, which thereafter worked like a Roman candle. Besides the swivel guns made on contract in Philadelphia, the Navy built a few, of an improved model, at the Charleston (Boston) Navy Yard. These pieces were never used in combat during the War of 1812 but were tested then and later used against the Barbary Coast pirates.

On September 22, 1821, a patent was granted to J. Jennings for an improvement of the Chambers gun.[47] Reuben Ellis of New York City in 1828 received an Ordnance contract for 520 rifles for the New York State Militia, "constructed on the principles of Jennings' repeating firearms with the sliding self-priming lock and the improvements therein . . . to receive at least four charges." [48] These were based on the Model 1819 rifle, using parts purchased by Ellis from contractors for that arm (North, Johnson, etc.). The Springfield Armory Museum has one of these, of 4-shot capacity, which appears to have a pistol lock (pl. 15b, d). Another of 10 shots owned by Edwin Pugsley, of the Winchester Repeating Arms Co., has a "North" lock dated 1825. The barrels of these rifles were made under subcontract by R. & J. D. Johnson, who also did the assembling.[49]

About 1860 the Springfield Armory made 1,000 Lindsay double-shot rifle muskets, firing superimposed charges.

The first revolving cylinder firearm patented in the United States and the first to be tried by the Services, was that of Capt. Artemus Wheeler of Boston, who was granted a patent on June 10, 1818, for a "gun, to discharge seven or more times." This arm was demonstrated to the Navy in January 1821. The Navy was not much interested, as the Chambers system was still under trial. Finally, a few of two types were purchased at $100 each. Samples of these are in the United States National Museum collection. One is an oversized pepperbox gun or carbine with a 12½-inch barrel group (pl. 16b). The other (pl. 16a) has a 4-inch cylinder and a 32-inch barrel. Both are smooth-bore of a size to fit the then-standard half-ounce rifle ball—0.525 inch. They are both seven shot and have hand-rotated cylinders. The system is that from which the more familiar Collier revolver was copied.[50]

In 1837 various Colt's revolving arms were tested at West Point. Among these were carbines, rifles, and caliber 0.64 muskets. Though there was a minority opinion to the contrary, the Board reported

that Colt's arms were not suited to military use. In 1839 Colt again approached various Army officers with regard to an "improved carbine," still the 8-shot type but possibly with an external hammer. Several officers were enthusiastic about the arm, and finally, in 1841, 100 carbines were ordered for Army trials, "some improvement having in the meantime been made in the construction of the arm." These were the hammer type, of six shots. Writing to Colt concerning these arms on February 26, 1841, the Chief of Ordnance said, "The carbine to be of rifle caliber, the cylinder with a specified number of boxes [6], to be plainly and substantially finished, the work to correspond as nearly as possible to that of the model arms of the present pattern." To use the standard rifle ball, which measured 0.525 inch, these carbines must have been caliber 0.52. When delivered the carbines were distributed for trial in lots of 25. Some went to Carlisle Barracks, some to Pilatka, Fla., and others to posts in the West. Apparently these were smooth bore.

Later in 1841, 60 similar but rifled carbines were ordered for the Navy for delivery to a "Naval Force being organized in New York for service in Florida," where they were used by the Marines. Despite some trouble with them in Florida, the Navy evidently liked the carbines, for on August 28, 1845, they placed another order through Army Ordnance. This contract, for 100 5-shot "boarding pistols" as well as 100 "six-charged" caliber 0.52 carbines, was placed with John Ehlers, trustee and former treasurer of the bankrupt Patent Arms Manufacturing Co. Only 50 of the pistols were available, but the entire order for carbines was delivered. This was the first official Government order for Colt revolvers, which were used by the Navy in California during the Mexican War, along with some of the then-new Model 1847 revolvers. The carbines were still in use in 1853, during the Naval expedition to Japan, being mentioned in a contemporary account of an official ceremony:

> Officers rigging in undress uniforms and arming mostly with cutlasses and Colt's six-shooters. . . . The column of escort with the Marines in front, a stalwart sailor with the broad pennant; commodore and staff; suite of officers; boxes containing president's letter, etc.; two men over six feet high, each with pikes upon which American ensigns were fastened, with revolving rifles slung across their shoulders.[51]

To judge from that description the Navy carbines must have had sling swivels. Some of the specimens now in collections have mixed numbers and bright-finished cylinders obviously not of Paterson Colt manufacture. When Ehlers took charge of the company assets he acquired a considerable number of parts and of unfinished arms. He

was still advertising the arms for sale in the late 1840's, presumably having them assembled and finished locally. Since the 1845 Navy order was filled from this residue of factory components, perhaps the carbines with serial numbers mixed and with odd cylinders constituted the arms then delivered. The three orders, one Army and two Navy, were all that the Ordnance Department placed for Colt long arms during the period under discussion. The next were well after the introduction of the new 1855 side-hammer models. All the hammer-type Paterson Colt carbines purchased by the Government were received and inspected by Captain Thornton in New York. He stamped his initials "WAT" in the wood of the stocks.[52]

From 1858 to 1865 Colt's revolving rifles and carbines were purchased in calibers varying from 0.44 to 0.64 (some of the last being smooth-bore arms firing the standard musket ball and some being rifled for the Navy). During the Civil War the Government purchased 4,612 Colt's revolving rifles,[53] and several States procured them for use by volunteers.

From time to time the armories made a few wallpieces—large-caliber rifles—intended for the defense of frontier posts. They were usually equipped with some form of barrel support, either a swivel or a projection on the stock to hook over a parapet. During the Revolutionary War General Washington ordered a few such weapons, of 2-ounce caliber, for long-range sniping. Prior to 1830 wallpieces were made at Allegheny Arsenal, at Rappahannock Forge, and at Springfield Armory.[54] In 1847 Harpers Ferry Armory made "four rifle-guns or wall-pieces" for use on the Western frontier. These were of caliber 0.75 bore and were mounted on a tripod stand.[55] Some of the earlier pieces for both Army and Militia use were ordered from makers of civilian rifles. These have the general characteristics of such rifles but tend to follow hardware and stock lines of the Harpers Ferry flintlock rifle, which was often cited as a pattern in contracts.

The bell-muzzled blunderbuss was another specialized arm made for and by the Government in small quantities, mostly for the Navy, which accounts for their resemblance to British arms of that period. (The Navy preferred the British "Sea Service" arms throughout the flintlock period, probably because of their brass hardware, and used secondhand and captured small arms extensively.) Some of these were made at Harpers Ferry in carbine or musketoon length (pl. 16c) and in the short-stocked one-hand type (pl. 16d). The latter was for use in rigging or other precarious positions. The former often had a heavy swivel for mounting in the bow of a landing boat. Some

of this type of weapon are found with American locks and (salvaged?) British hardware. Such fabrication would have been consistent with the small quantities produced, in order to meet Navy specifications for nonstandard arms, but collectors should bear in mind the possibility of recent assembly.

With the adoption of Hall's rifle, breech-loading arms were introduced into the United States service. In 1817 the inventor delivered the first of these—100 in all—under contract. A rifle thought to be of this type has a bronze receiver and Harpers Ferry rifle hardware. In 1819 Hall was employed by the Government to supervise manufacture of his rifles (pl. 11d) at Harpers Ferry Armory. In 1826 when Armory production of assembled rifles started, Hall began manufacture with complete interchangeability of parts, constituting our first use of this system in a Government establishment. Both Eli Whitney and Simeon North had formerly used the idea in the manufacture of contract arms.

For many years students of American firearms have used the term "common" rifle to mean only the Model of 1819. This is incorrect, though the use of the expression began at that time. After adoption of the breechloader, in 1819, that arm was designated "Hall's rifle." Any ordinary muzzle-loading United States rifle was thenceforth described officially as a "common" rifle. That this applied equally to the Model 1804 Harpers Ferry and to the Model 1819 contract arms is shown by an official listing of types of weapons, which includes "Common Rifle, half or whole stocked." [56] The term was also applied officially to the M1841 percussion rifle.

The first carbines of the Hall type were delivered in 1834. These were made originally as percussion arms, though the method of manufacture made the substitution of a flintlock rifle receiver a simple matter.[57] A letter written in 1834, from the Ordnance Office to members of Congress who had been furnished Hall's carbines, referred users of these arms to local hardware stores for a supply of percussion caps, as the Army had none for issue.[58] These first carbines were smooth-bore, caliber 0.52. Later some were rifled and others made of caliber 0.64 smooth-bore. Finally, after 1855, some of the smaller size were reamed up to caliber 0.58 and rifled.

In 1839, 100 flintlock Jenks carbines were purchased. Troops at Carlisle Barracks received 35 of these for trial, and soon thereafter the remaining 65 were converted to percussion. In the next few years a number of Jenks percussion carbines and rifles were ordered. Several models were used by both Army and Navy. Many other types of breech-loading carbines were purchased in the years before the

Civil War. The recorded orders (quantities received) were as follows:

Date	Number	Type
1855	20	Symmes (200 ordered)
1852–59	5540	Sharps (various models)
1855–57	300	Greene
1856	10	Schroeder
1857	270	Merrill, Latrobe, and Thomas
1857	400	Maynard (with tape primer)
1857–60	1500	Joslyn ("top lever" model)
1858	800	Burnside
1860	300	Smith (rubber cartridge)

A few Perry carbines were purchased by the Navy for trial in the late 1850's—the figures are not available.

From time to time promising breech-loading systems were tried. Among these was that of Morse, which was entered in trials in 1857, along with Sharps, Maynard, and other breechloaders. The 1857 Morse was a carbine of caliber 0.54, fitted commercially with extra barrels in caliber 0.50 (rifle) and 16 gauge (shot). The caliber 0.36 Sharps and calibers 0.58 and 0.69 Maynard conversions used in the 1857 trials employed the so-called "mule ear" cartridges. In 1858 a total of 54 caliber 0.69 muskets were converted to the Morse system at Springfield Armory. Samples were made also in calibers 0.54 and 0.58, but these never saw service. The Morse system was actually adopted as the standard method of converting muzzle-loading arms to breechloaders, and plans were made for extensive work at Harpers Ferry Armory, but the uncertainties of the 1860-61 period prevented carrying them out. Morse was about 15 years ahead of his contemporaries with the basic idea for what became the modern center-fire metallic cartridge. The Maynard conversion system (external priming) for muskets, in which a block carrying the cone-seat was hinged at the left side of the breech,[59] was not adopted.

The breech-loading principle met with fairly consistent resistance from both Army and Navy officials. One board, reporting on the Jenks carbine, expressed the opinion that it was a well-built arm and would be "suitable for service use if converted to a muzzle-loader." In 1856 Dahlgren said of breechloaders:[60]

> The chief difficulty would be to procure men, who would use without abusing these means, and to preserve the mechanism in good condition; not so much against the casualties of service as the neglect or ill-advised attentions of the store room, so fatal to many of the modern appliances that are consigned to its keeping. It can hardly be said that any important advantage or power can be

derived from loading at the breech, rather than at the muzzle. For there can be no weapon superior in either of these qualities to the American rifle, which belongs to the latter class. The facility and convenience of loading, alone remains as the unquestioned peculiar property of charging at the breech. In many cases, this may be desirable, but as a general rule, masses of men can load and fire with the ordinary muzzle-loading muskets so much more rapidly than is consistent with good aim, as to render the practice a notorious and crying evil, which is frequently commented on by the best military writers.

Secretary of War John B. Floyd, in his report for 1859, stated of the breechloaders: "These arms commend themselves very strongly for their great range and accuracy of fire at long distances; for the rapidity with which they can be fired; and their exemption from injury by exposure to long continued rains. With the best breech-loading arm, one skillful man would be equal to two, probably three, armed with the ordinary muzzle-loading gun. True policy requires that steps should be taken to introduce these arms gradually into our service, and to this end preparations ought to be made for their manufacture in the public arsenals." Again, in 1860, he said: "Immediate steps ought to be taken to arm all our light troops with the most approved of these arms. . . . I think it may be fairly asserted, now, that the highest efficiency of a body of men with firearms can only be secured by putting in their hands the best breech-loading arm. The long habit of using muzzle-loading arms will resist what seems to be so great an innovation and ignorance may condemn; but as certainly as the percussion cap has superseded the flint and steel, so surely will the breech-loading gun drive out of use those that load at the muzzle. For cavalry, the revolver and breech-loader will supersede the saber."

By the beginning of the Civil War, many inventors of breechloaders, of varying merit, were clamoring for Government orders. Though almost any arm that would work was purchased, the outstanding systems of the period—the Henry and Spencer—after being tested in 1861 by the Army and the Navy, were rejected by the former. In the letter to the Secretary of War, dated December 9, 1861, the Chief of Ordnance outdid himself in finding objections to these two weapons:

HON. SIMON CAMERON, Secretary of War:

SIR: As directed from the War Department, I have examined the reports upon the Henry and Spencer guns, accompanying the proposition to furnish these arms to the Government, and have also examined the arms. Both of them are magazine arms; that is to say, they have the cartridges for use carried in a magazine attached to or forming part of the arm, and fed out by a spiral spring. They require a special kind of ammunition, which must be primed or have the

fulminate in itself. The reports heretofore made are favorable so far as the limited trials went, but they do not go farther than to suggest or recommend the procurement of a sufficient number to place in the hands of troops in the field for trial. Indeed, it is impossible, except when arms are defective in principle, to decide with confidence in advance of such practical trials, on their value, or otherwise, as military weapons. I regard the weight of the arms with the loaded magazine as objectionable, and also the requirement of a special ammunition rendering it impossible to use the arms with ordinary cartridges, or with powder and ball. It remains to be shown by practical trial what will be the effect on the cartridges in the magazine, of carrying them on horseback, when they will be exposed to being crushed or marred, possibly to such an extent as to interfere with their free passage into the barrel; and whether they will be safe for transportation with the fulminate in the cartridge; also what will be the effect on the spiral spring of long use and exposure in the field. I do not discover any important advantage of these arms over several other breech-loaders, as the rapidity of fire of these latter is sufficiently great for useful purposes without the objection to increased weights from the charges in the arm itself, while the multiplication of arms and ammunition of different kinds and patterns and working on different principles is decidedly objectionable, and should, in my opinion, be stopped by the refusal to introduce any more, unless upon the most full and complete evidence of their great superiority.

In view of the foregoing, of the very high prices asked for these arms, and of the fact that the Government is already pledged on orders and contracts for nearly 73,000 breech-loading rifles and carbines, to the amount of two and a quarter millions of dollars, I do not consider it advisable to entertain either of the propositions for purchasing these arms.

Respectfully your obedient servant,

Jas. W. Ripley,

Brigadier-General

Many units, however, outfitted themselves with Henry or Spencer arms at their own expense, as these were obviously far superior to any other weapons then available. The first recorded use of Spencer rifles in action was in June 1863, in the hands of Wilder's Mounted Infantry at Hoover's Gap on the Tullahoma campaign.[61] Spencer carbines were first issued by the Government to the Michigan Cavalry Brigade in January and February 1863 and were used by that unit at the Battle of Gettysburg later that year.[62] When the war ended more Spencer carbines had been purchased by the United States Government than any other type of breechloader. (Appendix 5.) The Henry, however, continued to get the "cold shoulder." Nor did the Army ever warm up to the lever-action rifle, one of America's greatest contributions to the development of repeating firearms, and later generally accepted throughout the world by practical shooters.

During the Civil War a great variety of carbines of many calibers, some using paper, some linen, and others metallic cartridges, saw service. In September 1863, an Ordnance Board attempted to remedy

that situation, at least in part, by suggesting that seven of the types of carbines in use be chambered for only two types of cartridges.[63] They also recommended that new-type carbines purchased thereafter should weigh between 6 and 8 pounds (some light ones gave excessive recoil) and use the caliber 0.52 Spencer cartridge. The recommendations of the board were approved by the Secretary of War, with the reservation that an *ideal* caliber be sought, instead of the caliber 0.52 Spencer, then in production. (The same old story.) By consensus of the board, caliber 0.50 was eventually decided upon as the proper size, but because of the press of orders for arms nothing was standardized. Old-type carbines of the original calibers remained in production for the most part—only the new models were required to be of caliber 0.50, and most of these were delivered too late to see action in the war.[64] For use in the Civil War 31 different American-made carbines and several foreign varieties were procured by the United States; 407,734 of all types were purchased (Appendices 5 and 6).

During the 1840's and 1850's a few breech-loading pistols (Sharps, Maynard, Perry, Marston, etc.) were tried experimentally, but none was adopted. Revolvers were first used by the Army in the Florida War in 1838, when Colt sold some rifles and a few caliber 0.34 pistols to a commander in the field, General Jessup, for use by the Dragoons. Ordnance returns of that year show 25 revolving pistols on hand. The type was probably similar to the revolver shown on plate 17a. Between 1839 and 1841, there was considerable discussion about a heavier revolver for military use. The Army had been using a half-ounce round ball in a single-shot pistol. The large holster-size Colt revolver shown in plate 17b is caliber 0.52, evidently intended for the round pistol ball. Later (1846) the specification called for a half-ounce conical ball (caliber 0.44), which remained the official bullet shape thereafter. Another large caliber 0.52 Colt revolver now in the Colt collection at Hartford was evidently made after the Paterson period. This was plainly the development model for the Whitneyville-Walker type revolver, made before the ball was changed to conical. It was so described when lent to the 1876 Exposition at Philadelphia. The other differences are covered by the Army-approved changes in settling on the production model—trigger guard, angle of grip, and rammer level.[52]

A German publication of 1886[65] (long before any so-called Walker controversy) described the early United States Army revolvers as: The *"Texas Pistole, Kalibre* 34/100, made in 1838" and the *"Walker*

pistole, Kalibre 44/100, made in 1839-1842." It goes on to state that in 1847 General Taylor ordered a thousand Colt pistols which were made by Whitney. Confusion got into this story at an early date!

The first Colt pistol order for which I have found the contract was the one placed by the Ordnance Department for the Navy in 1845. In addition to 100 carbines, the order called for "100 boarding pistols, 5-charged, each $25.00, including appendages." The contract, dated August 28, 1845, was with John Ehlers, a Patent Arms Company assignee.[66] Only 50 of the revolvers were delivered (on September 10, 1845), perhaps all that were available. No doubt they were of the large commercial pattern "Texas" Paterson type. Specimens would have the inspector's initials "WAT" stamped on the grips.

Writing to the Secretary of War on April 5, 1848, Chief of Ordnance Talcott said, "Several hundred of Colt's Carbines and Rifles, and some pistols have been heretofor procured and used in the Florida War; also in 1845, and one thousand Pistols have recently been furnished to the troops in Mexico and a further supply of one thousand more pistols will soon be received from the inventor. . . . Whoever supposes that placing a Colt's Pistol in the hands of an ordinary soldier, will make him a 'Jack Hays' will be disappointed."

After the thousand "Whitneyville" Army revolvers were obtained in 1847 (pl. 17c), the "Dragoon" revolver remained the standard sidearm and was purchased in quantities through 1861. The design was modified in 1848 (pl. 17d), but the official designation was unchanged—it was still known as the dragoon, or holster revolver. The changes embodied in the arm when Colt started to make it at Hartford came from the inventor rather than the Army, as the following letter shows:

Ordnance Office, Feb. 14, 1848.

Saml Colt, Esq., Hartford, Connt.

Sir: Captain Thornton reports that the thousand pistols you are now making differ from the pattern of the first thousand furnished. Such being the case, and as there is nothing in all the letters to you either from the War Department or this office warranting a departure from the first model, it will be necessary, before the inspection of the 1,000 pistols can be permitted to procede, that you present to this office, for inspection and after approval to serve as a guide for the Inspection of the pistols you are now making a pistol with ALL its appendages exhibiting any alterations you may have made from the first pattern.

I am Sir, etc.

G. Talcott, Lt. Col. of Ordnance

Approved by Sec. of War on 8 Apr. 1848—agreed to modifications.

Evidently all the incoming mail had not been read, as there is in the Archives a letter written from Colt to the War Department late in 1847 concerning proposed changes in design of the revolver.

Washington, Oct. 4, 1847.

SIR: Since making the last thousand of my Patent Repeating Pistols I have made many experiments and have come to the conclusion that some alterations may still be made that will improve the arm for service. Therefore, should it meet your approbation I should like to make the following alterations in the 1000 I am now making for your department.

I propose to make the pistols about nine inches in length from the bottom of the chamber to the muzel of the barrel, to make the handle strap and bullet molds of brass in lieu of iron, and to use an iron ram and swab rod in place of the lever atached to the barrel. By these changes the pistols will be reduced in weight about three quarters of a pound and in length to suit the common holsters now in our service.

Very Respy
Sir
Your Obt Servt
SAML COLT

Hon. Secy of War

In another note sent the following day to Captain Thornton, Colt explained the proposed changes but added that if a new-type retaining spring he had devised were effective, the attached rammer would be preferable to a ramrod. He mentioned that the proposed new mold would cast one round and one conical ball. It seems strange that several months later Thornton and the Ordnance Department should have been unaware of proposed design changes.

Starting with the year 1855, orders for "Belt" pistols and "Navy" pistols (pl. 17e) began to be mixed in with the larger types. Perhaps these were the same, but an order dated April 21, 1856, contained "170 Belt pistols and 200 Navy pistols," the belt item (perhaps the 1849 model) having been changed from "Holster." The "New Model" Army pistol (pl. 17f) was first purchased in 1861.

Besides the Colt a number of other makes of revolvers were purchased in smaller quantities. In 1850 a few Wesson revolvers were ordered. The Massachusetts Arms Co. of Chicopee Falls sold the Army 600 Adams belt pistols (caliber 0.36) in 1856. Between 1856 and 1858, 356 North and Savage revolvers were procured, and in 1858, 500 single-action Starrs were ordered.

The Ordnance Department condemned the revolver principle as applied to any but sidearms. This attitude was consistent with its objection to repeating arms in general; a typical case was made in a letter written to the Secretary of War in 1861, by the Chief of Ordnance.

ORDNANCE OFFICE, WAR DEPARTMENT
Washington, February 6, 1861

HON. J. HOLT,
Secretary of War:

SIR: I have the honor to acknowledge the reference to this office of a letter of the Hon. S. R. Curtis, in behalf of the Committee on Military Affairs of the House of Representatives, submitting for a report thereon a memorial asking Congress to make an appropriation to secure the purchase or manufacture of revolving firearms, so as to arm our soldiers with them as far as possible, upon which subject I respectfully report:

It is not believed that what are called repeating arms are desirable for infantry of the line or riflemen. They are complicated in their mechanism, more liable to get out of order, and more difficult to be repaired than the muzzle-loading musket and rifle of the present model, which are unsurpassed for military purposes. The revolving repeater, by the rapidity with which five or six discharges can be made, then leaves the soldier with an empty weapon, which requires considerable time to replenish even under favorable circumstances, rendering it quite practicable in time of action for a soldier to discharge a muzzle-loading gun seven times in as short a space of time as the same number of discharges could be made from a six-chambered revolver. Excessive rapidity of fire is not the great desideratum for military guns. The soldier can carry only a certain weight of ammunition, which to be used with effect should be expended with deliberation. Revolvers have been known to discharge several of their charges (by accident) at the same time, thus rendering them unfit for troops formed in two ranks, for the reason that the front-rank men would be more in dread of those behind them than of the enemy. Repeating guns are more costly than muzzle-loading guns being necessarily heavier. The principle of the repeating arm is suitable for pistols, and should in my opinion be restricted to that weapon, and this is already adopted into our service to as great an extent as is deemed useful.

The proviso to the act of 23rd June, 1860, prohibits the purchase of arms of a patented character, and will prevent the purchase of revolving pistols without special authority of law, and it would be advisable that such discretionary authority be given in case the demands of the service should render it necessary to purchase such arms.

The letter of Hon. Mr. Curtis, with its inclosures is herewith returned,

Very respectfully, etc.
H. K. CRAIG
Colonel of Ordnance

The act that, in 1860, prevented the Ordnance Department from patronizing commercial sources of firearms was typical of American peacetime pinch-penny legislation. Dependent though we have always been in war upon commercial manufacturers, we do our best in time of peace, to discourage them and put them out of business. The basis for such a law was the fact that royalty had to be paid on a patented arm (no one recalled that our patent system was established to encourage and reward inventors), and that United States Armory costs for guns were less in most instances than commercial prices

(which included taxes, insurance, overhead, and a fair profit). Once we were committed to the Civil War, such restrictions were obviously incompatible with the national welfare, and about a dozen makes of American revolvers were purchased, as well as several more-advanced French types. (Appendices 5 and 6.)

In the Confederacy all serviceable military arms of flint and percussion types were used. In addition to stocks of United States Government weapons in Southern arsenals, many were made during the war, following standard United States or European patterns, and a few distinct types were developed.[67]

The Confederate "Field Manual for the Use of Officers on Ordnance Duty" lists the official arms of the Confederate States. As sources of official Confederate information are few, the portion of this manual devoted to small arms is reproduced herewith:

The C. S. bullet is a cylinder surmounted by a conoid, weighs 550 grains, and has three grooves around the bore to hold the grease for lubricating, and to guide the bullet in its flight, preserving its point foremost.

The English bullet (known as the Pritchett bullet) has a perfectly smooth exterior. A conical wedge of box wood is inserted in the cavity of the bore, chiefly to preserve its form in being transported.

Charge of powder.—The charge of the old smooth bored musket was from one-half to one-third the weight of the projectile. The charge for elongated expanding bullets varies from one-tenth to one-seventh the weight of the projectile.

Different Kinds of Small Arms

The small arms adopted for service are:

The rifle musket, model 1855.
The rifle musket, model 1842.
The rifle, model 1855.
The rifle, model 1842, reamed out to .577 inch.

No model has yet been adopted for a carbine for the cavalry service; several different patterns are now in the hands of the troops.

A *repeating pistol* is issued to the cavalry.

The uniform calibre of .577 inch is adopted in the C. S. service for all *rifles* and *rifle muskets.*

Rifle musket.—The rifle musket of model 1855 combines in one piece the range and accuracy of the rifle, with the advantages of the smooth bored musket, as regards lightness, quickness of loading, and facility of handling, as a pike.

Length of barrel	40	inches.
Length of arm with bayonet	74	"
Weight of barrel	4.25	lbs.
Weight of arm complete	9.90	"
Weight of projectile	550	grs.
Weight of powder	60	"
Initial velocity	960	feet.

Rifle.—The rifle differs from the rifle musket, in having a shorter and stouter barrel, a sword bayonet and brass mountings.

Length of barrel	33 inches.
Length of arm with bayonet	72 "
Weight of barrel	4.80 lbs.
Weight of arm complete	13. "
Charge (projectile and powder) same as rifle musket.	
Initial velocity	910 feet.

Enfield rifle.—Many are in the C. S. service, obtained by purchase and capture—so called because made after the model of the English government rifle, manufactured at Enfield. It has three grooves.

Calibre	.577 inches.
Length of barrel	39. "
Length of arm with bayonet	73. "
Weight of arm complete	9.19 lbs.
Weight of projectile / Weight of powder	as rifle musket.
Twist	one turn in 6 feet 6 inches.

Smooth bored musket.—The calibre of the *smooth bored musket* (model 1822 and 1840) is considerably larger than the rifle musket; the former being .69 inch, and the latter .577 inch, and with it, more powder is required to project a ball of less weight, than with the rifle. Many of these models (1822 and 1840) are in our service, some of them being still used with the flint lock.

Length of barrel	42. inches.
Length with bayonet (model 1822)	73.6 "
" " " (model 1840)	75.8 "
Weight of arm complete (model 1840)	10.18 lbs.
Weight of round ball	463 grains.
Weight of powder	110 "

English smooth bored musket.—Some smooth bored muskets of English manufacture (old models) are in our service of very large calibre, being .75 inch. Special ammunition is made for them.

Musketoon.—The *musketoon* is a short musket, having a barrel 26 inches in length and calibre .69 inch. This is an old model, and was formerly issued to the cavalry and artillery in the U. S. service. Some are now used by the C. S. cavalry.

Belgian rifle.—The Belgian rifle is a *carbine à tige,* having a *stem* in the chamber of the breech, with a calibre of .70 inch. It has *four* grooves, and is properly used with a solid projectile of 756 grains in weight.

Brunswick rifle.—This rifle has two grooves, which diminish in depth to a certain distance in the barrel, when they are eased off smooth with the bore—calibre about .70 inch. Some of the Belgian and Brunswick rifles are in the C. S. service, both by purchase and capture.

Carbine.—The term *carbine* is applied to an arm used by mounted troops, intermediate in weight and length between the rifle and pistol. The name is derived from a company of cavalry called *carabins,* to whom they were first issued. There are several different varieties in our service.

Breech loading carbines.—Nearly all the carbines in our service are *breech loading.* All may be divided in two classes, those which have *movable* cham-

bers and those which have *fixed* chambers. The following kinds are in our service:

Hall's carbine—This is an old carbine with movable chamber, calibre .52 inch, length of barrel 21 inches. It was formerly used with a flint lock in the U. S. service. Some with percussion locks are in the C. S. service.

Burnside's carbine has a calibre of .54 inch, and a movable chamber. The cartridge is enclosed in a conical brass case.

Sharp's carbine has a fixed chamber. That in our service has a calibre of .52 inch.

Maynard's carbine has a fixed chamber. There are two calibres in our service. Large size, calibre .52 inch. Small size, calibre .36 inch. *Maynard's primer,* attached to this carbine, contains 60 primers in a row, on a tape or ribbon of paper. A primer is moved under the hammer by the act of cocking. The charge is enclosed in a cylinder of sheet brass.

Grape-shot pistol.—This pistol is manufactured by M. Le Mat of Paris. It has a *cylinder* which revolves, containing *nine* chambers, a *rifled barrel* and a *smooth-bored barrel.* The latter receives a charge of eleven buckshot, and is fired by a slight change in the hammer. Some are in our service.

Nomenclature

The parts of a *musket* or *rifle,* are the *band, breech screw, tang screw, cone bayonet, lock, two side screws, mountings, ramrod, stock* and *tip.*

Lock.—The parts of the *lock,* are *lock plate, hammer, tumbler, bridle, bridle screw, sear, sear spring, sear-spring screw, main spring, swivel, tumbler-and-swivel pin.*

Mountings.—The mountings consist of *upper and lower bands, middle band, middle-band swivel, band springs, side-screw washers, guard, guard plate, guard bow, trigger, trigger screw, butt plate, two screws for butt plate.*

Implements.—The implements for use in the field, are *screw driver,* with *cone wrench, wiper, ball screw* and *spring vice.*

Principal Dimensions, Weights, etc. of Small Arms

Dimensions		Rifle muskets 1855	Rifle muskets 1842	Rifles 1855	Rifles 1842
		Inches	Inches	Inches	Inches
Barrel	Diameter of bore	0.577	0.69	0.577	0.577
	Variation allowed, more	0.0025	0.015	0.0025	0.0025
	Diameter at muzzle	0.78	0.85	0.90	0.90
	Diameter at breech between flats	1.14	1.25	1.14	1.15
	Length without breech screw	40	42	33	33
Bayonet—Length of blade		18	18	21.7	21.7
Ramrod—Length		39.60	41.70	33.00	33.00
Stock, with butt-plate and tip—Length		52.85	....	....	....
Arm Complete	Length without bayonet	55.85	57.80	49.3	48.8
	With bayonet fixed	73.85	75.80	71.8	71.3
	With butt piece				
Grooves	Number	3	3	3	3
	Twist, uniform, 1 turn in	6 ft.	6 ft.	6 ft.	6 ft.
	Width	0.30	0.36	0.30	0.30
	Depth of muzzle	.005	.005	.005	.005
	Depth at breech	.015	.015	.013	.013

WEIGHTS		Lbs.	Lbs.	Lbs.	Lbs.
BARREL, without breech-screw		4.28	4.19	4.8	4.8
LOCK, with side-screws		.81	.95	.81	.55
BAYONET		.72	0.64	2.15	2.15
BUTT-PLATE		.375	....	....	....
ARM COMPLETE	Without bayonet	9.18	9.51	9.93	9.68
	With bayonet	9.90	10.15	12.08	11.83
	With butt piece				

What is commonly known as the *Mississippi rifle* in the C. S. service, was made after the model of 1842, with a calibre of .54.

Merrill's carbine has a fixed chamber, and a calibre .54 inch.

Colt's revolving carbine has a cylinder with *six* chambers, and a rifled barrel, of calibre .56 inch.

Colt's pistol is used in our service, and is constructed on the revolving principle, with a cylinder containing *six* chambers, and a rifled barrel.

There are two kinds in use; *Colt's army pistol* has a barrel inches in length, of .44 inch calibre. The *navy pistol* has a barrel inches in length, of .33 inch calibre.

At the beginning of the Civil War both the United States and the Confederate States made intensive efforts to purchase or contract for arms in Europe. Most of the foreign armies had made radical changes in the design of their small arms during the preceding decade [68] and as a result had stocks of obsolescent types they were glad to sell. As agents of the two warring Governments were under great pressure, they had to take about what was offered them, though a few contracts for improved types were given to commercial arms manufacturers in Belgium and England. Thus, though Ordnance officials of North and South both appreciated the advantages of standardized weapons, circumstances forced the acceptance of a great assortment of foreign materiel, ranging in caliber from 0.54 to 0.79. In the initial instructions given United States agents in Europe, an attempt was made to restrict purchases to standard American calibers: "All the arms are to be of .58 or .69-inch caliber, or with such slight differences that they will take our ammunition for those calibers." [69] On receipt of these specifications a reply was made enumerating the difficulties experienced: "Difficult matter to furnish 'rifle muskets' of exactly .58 or .69 caliber—best shown are smooth-bore muskets, cal..70 to .72." [70]

In the South, the following foreign-made arms are known to have been purchased and used:

Origin	Name or Type	Caliber [71]
British	"Tower" musket, M1842	.75
British	"Brunswick" rifle, M1835/51	.704
British	"Enfield rifle, M1858 (short)	.577

British	"Short Enfield" rifle	.577
British	Rifled musketoon	.577
British	Carbine	.577
British	"Sharpshooter" rifle	.45
British	Whitworth rifle	.45
British	Kerr rifle (Enfield)	.44
British	Calisher and Terry carbine	40 balls per pound
Austrian	Rifle	.54
French	LeMat carbine and revolver	.42 and .60 (ball and shot)

In the North, an even wider variety was procured.[72] This official tabulation includes both American and foreign types:

Name or Type	Caliber[73]	Number Obtained
French carbine	.60	200
Foreign carbines	.54, .577, .71	10,051
Springfield rifle	.58	670,617
Colt revolver rifle	.44, .56	4,612
Henry rifle	.42 (.44)	1,731
Sharps' rifle	.52	9,141
Spencer rifle	.56, .52	12,471
Rifle-musket	.69	1,832
Enfield rifle	.577	428,292
Enfield short rifle	.577	8,034
Boker (Austrian)	.71	162,533
Boker (Austrian)	.70	25,000
French rifle	.71	44,250
Belgian rifle	.69, .71	57,467
Austrian rifle	.72	226,294
Prussian rifle	.69, .70, .71	59,918
Jager rifle	.54	29,850
Suhl rifle	.58	1,673
Tower rifle	.71	4,182
Garibaldi rifle	.69, .71	5,995
Prussian musket[1]	.69, .70, .71	81,652
Foreign muskets[1]	.69, .70, .71, .72, .73, .74, .75, .79	29,201
American musket[1]	.69	2,181

[1] Smooth-bored.

The totals given do not include the large numbers of carbines purchased in the United States.

In the South, and in the North to a lesser extent, it became necessary to use available United States Army small arms of obsolete types. Eventually the supply of spare parts for these bogged down completely, and when an arm "went bad" the soldier either traded with some less fortunate individual or two or more pieces were combined to make a single serviceable one. The United States classified small arms by their relative serviceability. Thus *first class* arms

included breechloaders and all regular, rifled caliber 0.54 or 0.58 models of 1841, or later. The better grade foreign rifled-muskets of calibers 0.577 and 0.58 were also in this group. *Second class* arms included the converted United States or foreign rifled-muskets of calibers 0.69, 0.70, and 0.71, plus the second-grade foreign rifles of calibers 0.577 and 0.58. *Third class* included United States smoothbore muskets, sporting rifles and second-grade foreign rifled-muskets. *Fourth class* included United States flintlocks and the odd-size foreign arms. First-line troops were supposed to be issued only first or second class arms. (Appendix 6.)

During the course of the Civil War several different types of machine guns were employed in small numbers. The most successful was the Gatling, which embodied a circular group of barrels rotated manually and fed cartridges from a hopper. The Union repeating gun or "coffee mill" gun had a single barrel with a number of hopper-fed chamber pieces equipped with nipples at the rear. The Requa battery gun had multiple barrels in a horizontal row; they were all fired at once. Other multibarrel types such as the Rafael were used but were little more than curiosities. Machine-gun mechanisms had not quite been perfected, nor had their proper tactical employment been visualized.

ACCOUTREMENTS

In the early years of the United States Army, accoutrements or accessories for use with small arms were supplied by the gunmaker along with the weapon. In view of the large variety of arms in use it was necessary that each have a bullet mold, wiper, and ball extractor made to fit. These were usually included in the contract for an arm. A suitable powder horn was sometimes included in the contract price. On November 18, 1775, an order was issued at GHQ, Cambridge—"Commissary General to order all the horns of the bullocks that are killed for the use of the army to be saved and sent to the Quartermaster General, who is also to provide as many as he can get, and have the whole made into good powder horns for the use of the troops." [74]

The official cartridge box of the Revolutionary War is indicated by a resolution of Congress, passed on March 19, 1778: "The cartridge boxes to be made to hold at least 29 rounds of cartridges when made with ounce balls, and the cover of good substantial leather with a small cover or flap under it that the ammunition may be most effectually guarded against the rain. That in case in any State they have quantities of tin, instead of the cartouch (*sic*) boxes, an equal

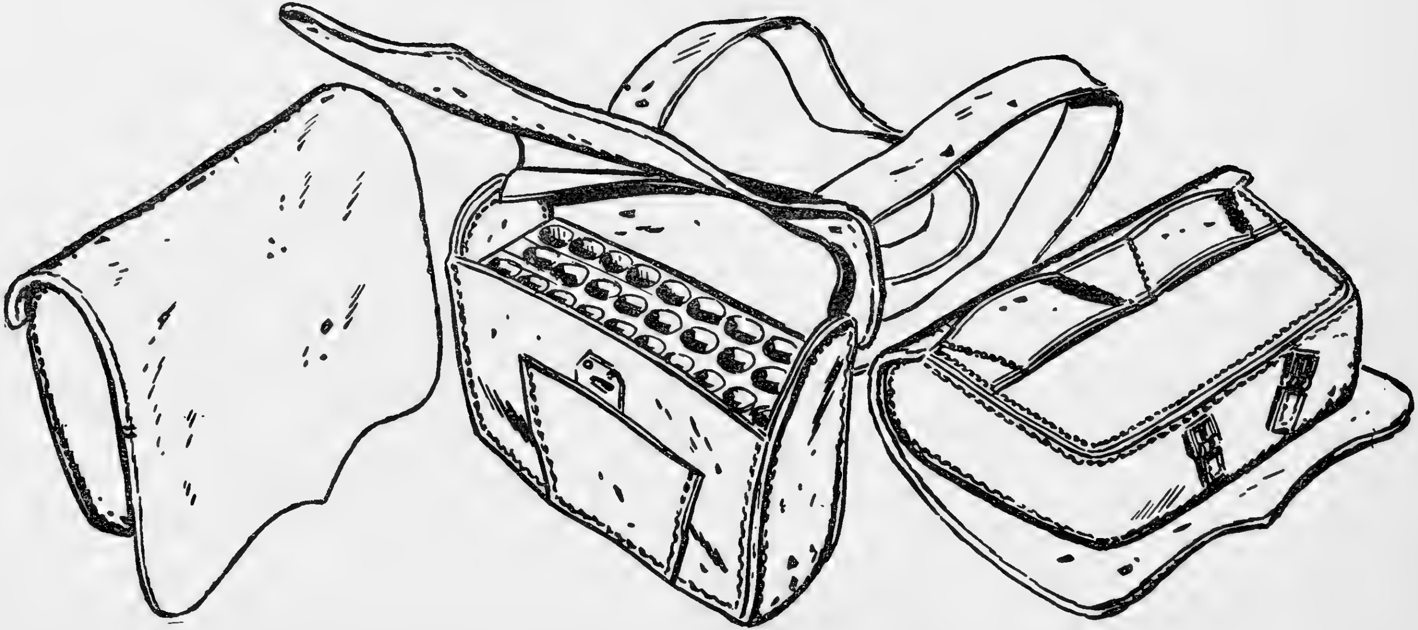

Fig. 8.—Cartridge box, 1780-1808. (McBarron, Mil. Coll. and Hist.)

number of tin cartridge cannisters be furnished agreeably to a pattern or description to be sent to the Board of War." [75] Inspector Col. John Whiting, in reporting to the Secretary of War, in 1809, referred to cartridge boxes as follows: "The best model of a Cartridge Box is that established by long use in the revolution, and will contain 29 rounds in the wood, 11 in the tin at the bottom, which also has a compartment for spare flints—on the outside a receptacle for oilcloth, worms, & screwdriver—a large flap which secures the whole from rain & supported by a Shoulder Belt." Such a box is illustrated in figure 8.

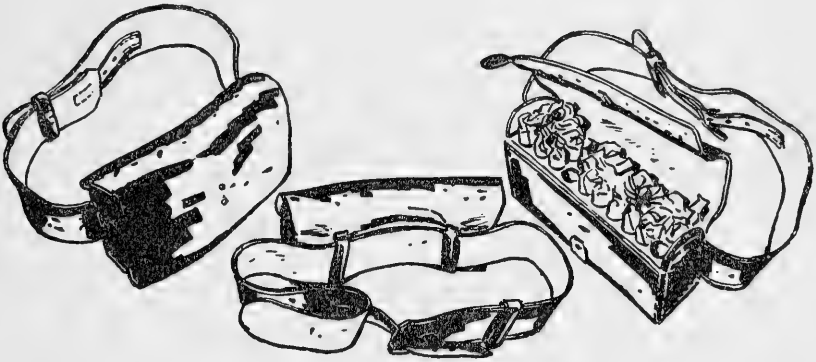

FIG. 9.—Cartridge box, militia, 1792 Regulations. (McBarron.)

The Act of 1792, which established a uniform militia, required each soldier to be equipped with "a good musket or firelock, a sufficient bayonet and belt, two spare flints and a knapsack, a pouch with a box therein to contain not less than twenty-four cartridges, suited to the bore of his musket or fire-lock, each cartridge to contain a proper quantity of powder and ball; or with a good rifle, knapsack, shot pouch, and powder horn, twenty balls suited to the bore of his rifle, and a quarter of a pound of powder. . . ." Officers carried 12 cartridges in a box, and horsemen used double pistol holsters, with bear skin flaps, containing compartments for 12 cartridges. The Infantry cartridge box was described as "a cartouch pouch of stoutest blackened leather, covering a case of wood, holding 24 or more musket-ball cartridges in rows. Worn on the belt." [76] Such a box is shown in figure 9. A type of box used during the War of 1812 was described as containing a block of black walnut bored with 24 0.8-inch holes.[77]

During the period 1808-14, though riflemen customarily loaded with loose powder from a horn or flask, they carried cartridge boxes

also. The drill prescribed that they load from the box when serving in ranks as infantry, but from the horn, using an exact powder measure, when acting as riflemen, not firing by command. The rifle box was on the waist belt; the horn and pouch on shoulder belts. The pouch, which contained two partitions for bullets and accoutrements, went over the right shoulder; the flask belt over the left. The box was described as of flexible leather, containing two rows of unsoldered tin cases, holding 30 or 36 rounds of ball cartridges.

When describing musket cartridge boxes in 1808, the Purveyor, Tench Coxe, said, "Our new boxes are with blocks bored for 26 cartridges of ball nineteen to the pound of stout leather, having under the block a tin container of three compartments for 6 cartridges to be in each end compartment and for flints and oil rags in the middle one. To this a little leather pocket in front of the box affords admittance." Speaking of these the same year, he said, "Blocks bored to hold 26 cartridges, & tins & 2½ inch wide belts, complete at the price of one dollar and thirty seven cents each, with its block, tin, and cross belt, complete." This sort of box is shown in figure 10. An apparently identical specimen in the Lewis collection is made for a 2½-inch belt, though it now has a 2-inch replacement of buff leather dating from about 1835. It is marked "James Boyd Boston Maker" and has the acceptance stamp of Inspector Charles Williams, who inspected arms and accoutrements in the New England area between 1808 and 1818. The pine block has 26 holes, which fit musket cartridges of the 1812 period perfectly, and 12 such cartridges fit into the lower tin. Boxes such as this, with minor changes in dimensions to accommodate the shorter cartridges, used later, were standard through the rest of the flintlock period.

In Ordnance regulations published in 1814, musket accoutrements included "cartouch box and belt, bayonet, scabbard and belt, gun sling, brush and pricker, ball screw, and screw driver [pl. 20] . . . the whole valued at $3.21." (Appendix 8.) One of the 1815 contracts was to Lewis Enters of Philadelphia, for "500 powder horns at 90 cents each." Powder horns were also made at the Government arsenals. Plate 21a shows one made at Allegheny Arsenal for use in priming cannon.

The accoutrements listed for issue with Hall's rifles in 1827 included bayonet, ammunition flask, bullet mold, wiper, and screwdriver. One spring vise was issued to every 10 rifles.

The first reference I have seen to contract purchases of powder flasks is in a letter from the Chief of Ordnance to Allegheny Arsenal,

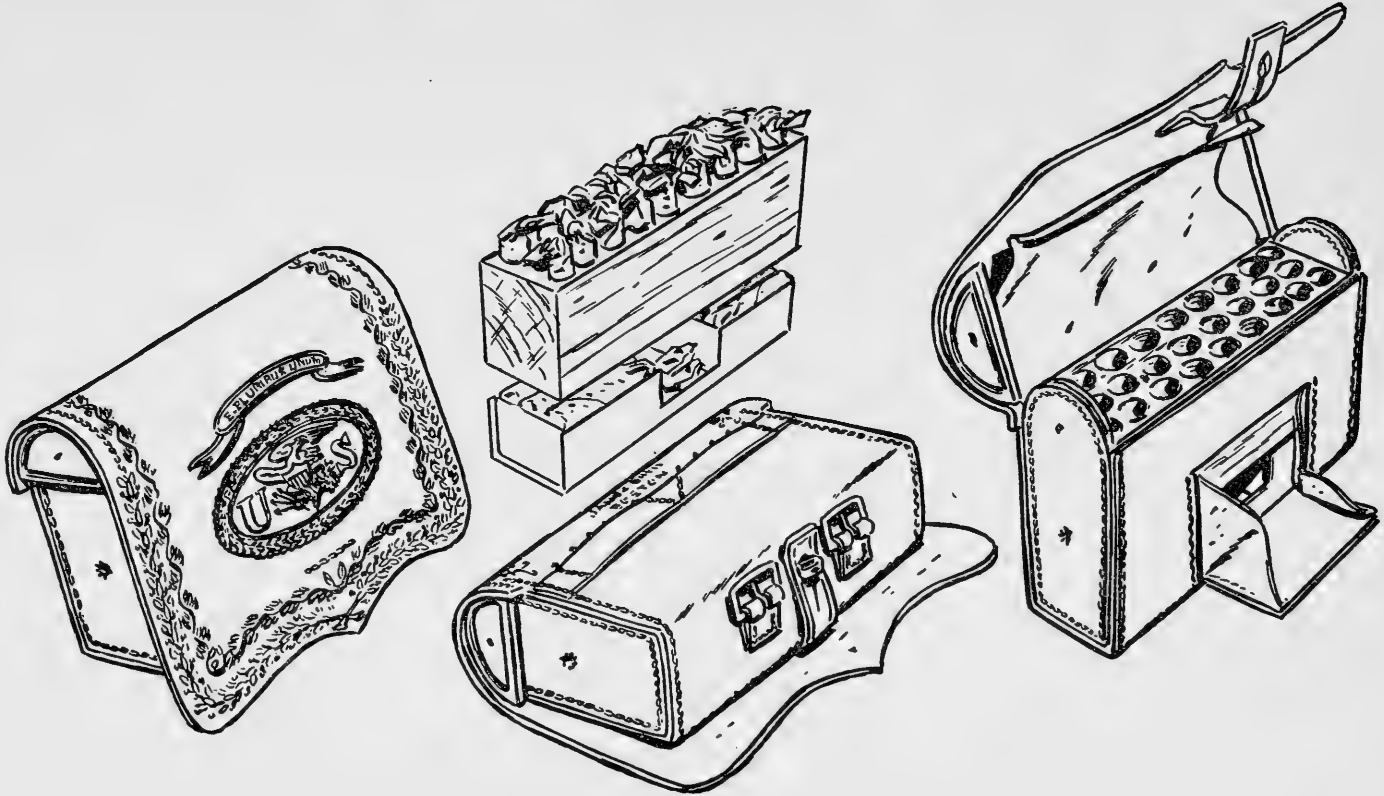

FIG. 10.—Cartridge box, 1808-1839. (McBarron.)

written November 10, 1831. He referred to a large supply of riflemen's accoutrements being made in New York. Again, on March 2, 1832, he said, "The leather parts of 2,000 sets of Rifle accoutrements of superior quality and workmanship, are now completed in the City of New York, and the flasks for them, it is expected will be made in about 6 weeks from this date." Earlier, on March 9, 1827, "500 sets of rifles and accoutrements for the Western states" were sent to Allegheny. It is supposed that the contract in effect in 1831 was with R. Dingee of New York, who made flasks embossed with an eagle and bugle on an 1832 contract (pl. 21d).

In 1834 the standard accoutrements were: [78]

Cartridge box, black, eagle stamped, carrying 26 rounds in wooden case and 24 in tin case.
Pistol cartridge box, carrying 12 rounds.
Carbine cartridge box, carrying 30 rounds.
Pistol holster (pair), carrying 10 rounds.
Copper rifle flask, holding 8 oz.; min. charge 85, max. 100 grains.
Rifle pouch, black.
Hall's rifle flask may be used instead of the copper flask.

The belts used with these accoutrements were of white or buff leather. The rifle pouch and flask were carried on a single shoulder belt which had two pairs of small straps at the ends. Rifle cartridge boxes were no longer listed.

Appropriations for the year 1837 included an item for procuring 10,000 rifle flasks at $1.70 each, the stock on hand having been exhausted by issue to the troops.[79] The flasks purchased under that authorization (pl. 21e,f) were a type that continued in use for many years. Among the contractors were N. P. Ames and Batty. By 1839 there were some minor changes: [80]

Accoutrements for small arms—*Infantry*
159 . . . Cartridge box (black) eagle stamped, carrying 26 rounds in wooden case and 16 rounds in tin case.
Cavalry—Pistol cartridge box, carrying 12 rounds.
Holsters, pair, with hair seal skin or patent leather, carrying 10 rounds of ammunition.
Rifle.
Rifle pouch, black.
Flask and pouch belt.
Copper flask, carrying 8 ounces powder. Minimum charge, 85 grains; maximum charge, 100 grains.
Add for Hall's Rifle—
Note: Hall's flask may be used instead of the copper flask; when properly made, its cost is about the same.

There was also a carbine cartridge box in 1839, which held 30 rounds. The Infantry box was carried on a $2\frac{1}{4}$-inch white leather belt. A similar belt carried the bayonet and had a round, brass eagle plate, $2\frac{1}{2}$ inches in diameter. The waist belt had an oval brass US plate. The gun sling was of russet leather, $1\frac{1}{4}$ inches wide, with a brass hook and standing and sliding loops. About 1840 the bayonet belt was discontinued, and that arm was carried on a frog sliding on the waist belt. Thereafter the eagle plate was put on the cartridge belt. In 1839 mention was made of a "new pattern" pistol holster having bearskin covers. However, the 1841 Ordnance Manual called for black leather covers.

The first major change in the 1808-1839 cartridge-box series appears to have come in 1834. Then the first substantial rearmament after the War of 1812 began. The new improved powder resulted in a musket cartridge considerably shorter than before. To fit it the depth of the hole in the cartridge block was reduced and the same amount added to the height of the tin in the bottom, making room for three layers of cartridges. The British caliber 0.75 rounds having been eliminated from the Service, it was possible to place four cartridges in a row in each end of the storage tin, making a total of 24 in the bottom of the box. It must have been decided that the extra eight cartridges were too burdensome, and so in 1839 the tin was again made for only two layers, thus holding 16 cartridges. The block was then dropped by the same amount, and the front edge of the box was cut down to correspond with its upper edge.

Why a distinct Hall's flask was used is not known to me. The regulation rifle flask, as described, should have been suited to either the Hall's carbine or rifle, as their charges at that time were 85 and 100 grains, respectively—the limits of the rifle-flask charger. The description of the Hall's flask seems as uncertain as its purpose. Contrasted to "the copper flask" in the regulations, by inference it may well have been made of brass or tin. An 1839 letter to the Adjutant General in regard to Hall's rifles gives a hint as to this flask in the statement "The powder and ball flask used as an equipment for this rifle is badly made and does not last long." [81] As this piece of equipment was earlier called an "ammunition flask" rather than a powder flask, it may have been a combination affair. Special Hall's molds were also supplied, though the arm used the standard half-ounce rifle ball.

In 1840 a new series of boxes was prescribed for use with the new flintlock arms recently adopted. The musket box no longer had the embossed eagle, but a brass plate. The leather belts were changed

from buff to black, or at least the buff was no longer listed. (Alternate use of black leather had been noted as early as 1834.) The boxes had brass US plates, the infantry plate was oval, 3.5 by 2.2 inches; the carbine and pistol size was 2.8 by 1.6 inches. The lengths of these boxes were 7.7, 7.0, and 6.2 inches, respectively. Construction was similar, except that the infantry box had unequally divided upper tins, the others all square subdivisions, and the pistol box had no implement pouch on the outside. The rifle pouch and powder flask were suspended by short straps from a shoulder belt (fig. 11).

With the change to the percussion system, in 1842, came corresponding changes in accoutrements. The annual report of the Chief of Ordnance for the year 1846 lists:

Accoutrements:	Infantry:	cartridge box, cap pouch, and pick.
	Rifleman:	flask, bullet pouch, rifle cart. box, cap pouch.
	Cavalry:	pistol, cartridge box, cap pouch.

During the Mexican War accoutrements were made by the following contractors: Dingee & Pray, R. & H. A. Dingee, Henry A. Dingee, R. Dingee & Sons, and Robert Dingee, of New York; James Boyd, Boston; J. Coffin, Jr.; N. P. Ames, Cabotville; J. H. Batty & Co., Springfield; and John V. Pittman, Orlando S. Williams, J. T. Bell, and C. S. Storms, all of New York. With the percussion system a new style of cartridge box came into use. Two instead of three rows of cartridges were carried in the top part, making the box much shallower. The space within was divided vertically by two tin boxes, each partitioned into an upper and a lower section. The lower, opening on the side, held a paper packet of 10 cartridges. The upper, open on top, held 10 loose cartridges vertically, separated by a tin strip so that four were to one side and six to the other. Cartridges were used one at a time by lifting them out of the top tray. After several were used, the divider kept the rest from falling down out of reach. When the whole top tray was expended, the tin box was lifted to expose the lower section, and the reserve package removed, opened, and its contents placed in the upper tray. The caps, wrapped with the cartridges, were put into the cap pouch. This type of cartridge box is shown in figure 12. Such boxes were later converted for use with caliber 0.58 ammunition by placing a bored wooden block in the upper tray. Rifle, carbine, and pistol cartridge boxes were of similar construction but of smaller dimensions. Figure 13 shows a rifle cartridge box.

When the Whitneyville-Walker model Colt revolver was adopted

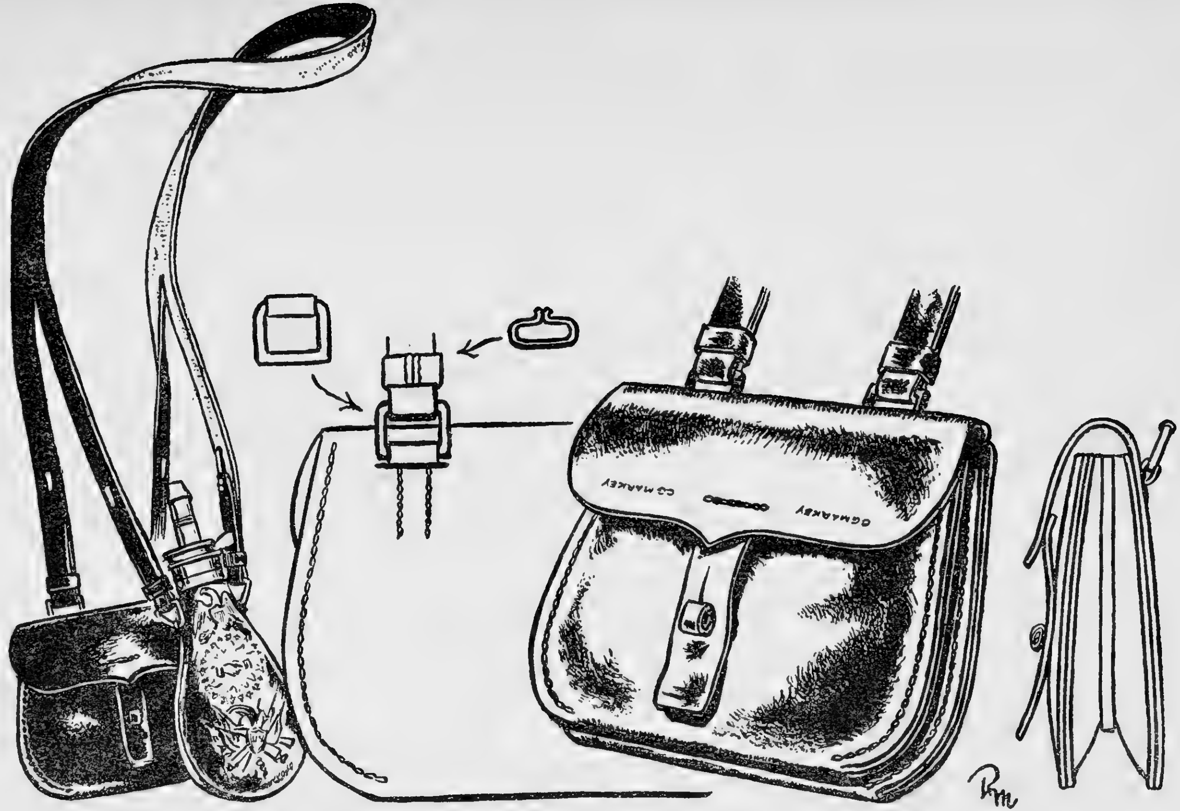

FIG. 11.—Rifleman's pouch as described in Ordnance Mannuals of 1841 and 1850. (Drawing by R. L. Miller of a specimen collected by Don H. Berkebile.)

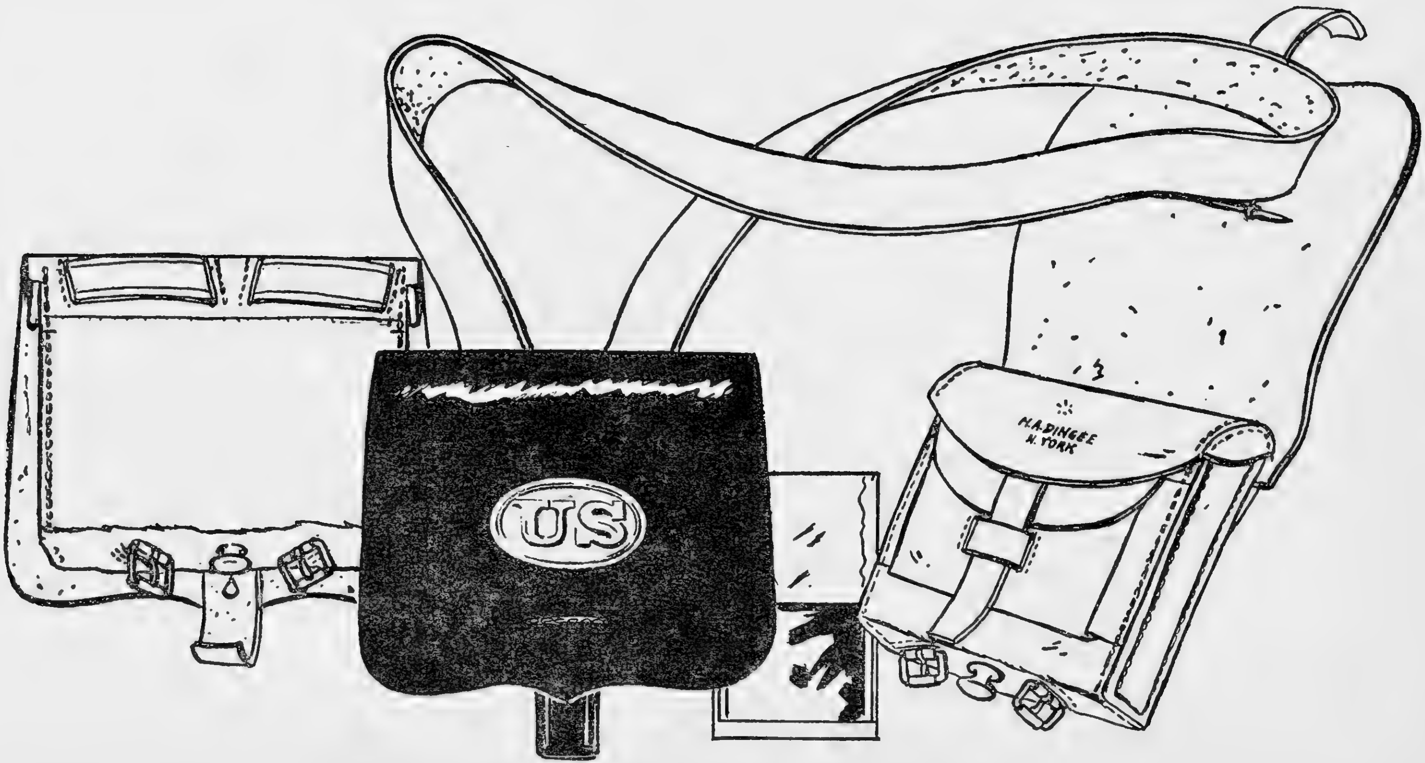

FIG. 12.—Cartridge box for Model 1842 percussion musket. (R. L. Miller.)

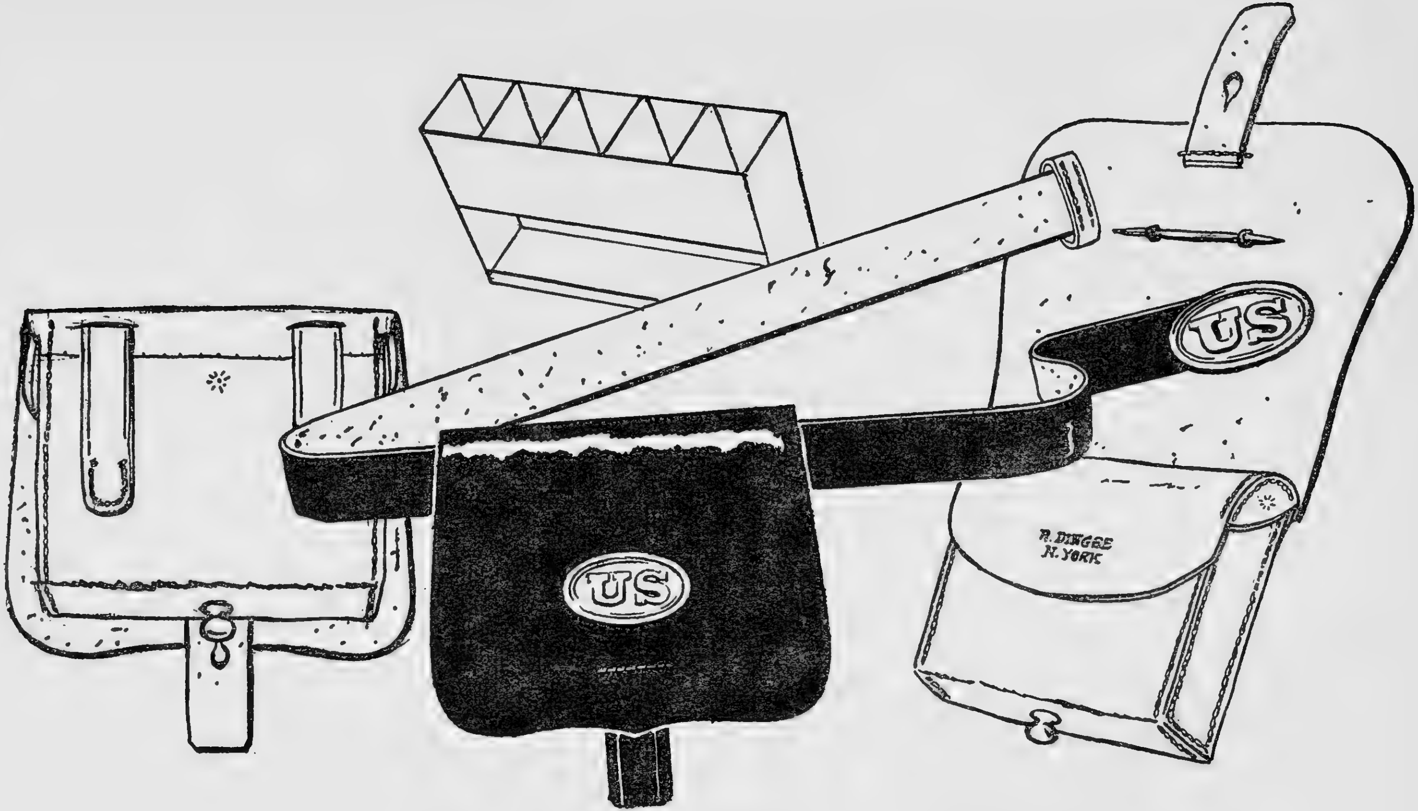

FIG. 13.—Cartridge box for percussion rifle, 1850. (R. L. Miller.)

in 1847 a flask of the rifle type was supplied with it. About all that is known of these flasks from official description is that they were provided with triangular carrying rings and probably had a variable charger, as there were two different bullets specified for the revolver. Plate 18 shows the Walker revolver with its accessories, as issued. The flask shown is believed to be that furnished. It throws the proper charge and has the initials of William A. Thornton, who inspected most Colt products purchased by the Army during the decade following his appointment in 1840. Single- and 6-cavity bullet molds came with the revolvers.

Like the single-shot martial pistols, the first Army revolvers were carried in double saddle holsters. Several variations of these are known. One, shown on plate 19a, appears to be the earliest type, probably one of those Walker had made at New Orleans when the Government version was not ready. Their shape is symmetrical, like the older pistol holsters. The brass muzzle caps are embossed with large Texas stars. The type probably made officially, to fit the wooden revolver Walker supplied, shows a refinement in design, with the leather formed to fit the revolvers, otherwise following the standard pistol design with plain brass caps and black patent leather bound with rawhide (pl. 19b). The next step was a similar holster made shorter to fit the 1848-type Dragoon revolver, which would also go into a regulation pistol holster, though a bit sloppy as to fit. The covers on this type were much broader. Some combination holsters were made to carry a Model 1855 pistol carbine plus its separate extension stock on one side and a Dragoon revolver on the other. No doubt it was when Colt saw this that he got the idea of such an extension stock for revolvers, though such holsters for two Colts are not known (with pocket for stock included).

The change to caliber 0.58 for rifle-muskets and rifles in 1855 brought corresponding changes in the cartridge box. The new box (fig. 14), essentially the 1842 style scaled down, continued in use through the 1860's. The Civil War infantryman carried 3.5 pounds of ammunition.[82] The 40 cartridges were carried in the box, suspended from a shoulder belt. The rifle box of prior years was usually carried on the waist belt, and only the musket box with its heavier ammunition was slung from the shoulder. During the war the use of the shoulder strap predominated, the rifle and rifle-musket then using the same cartridge. The leather pouch used for percussion caps, essentially the same as the Confederate specimen, Fig. 15, had a sheepskin lining to keep them from falling out while in action with

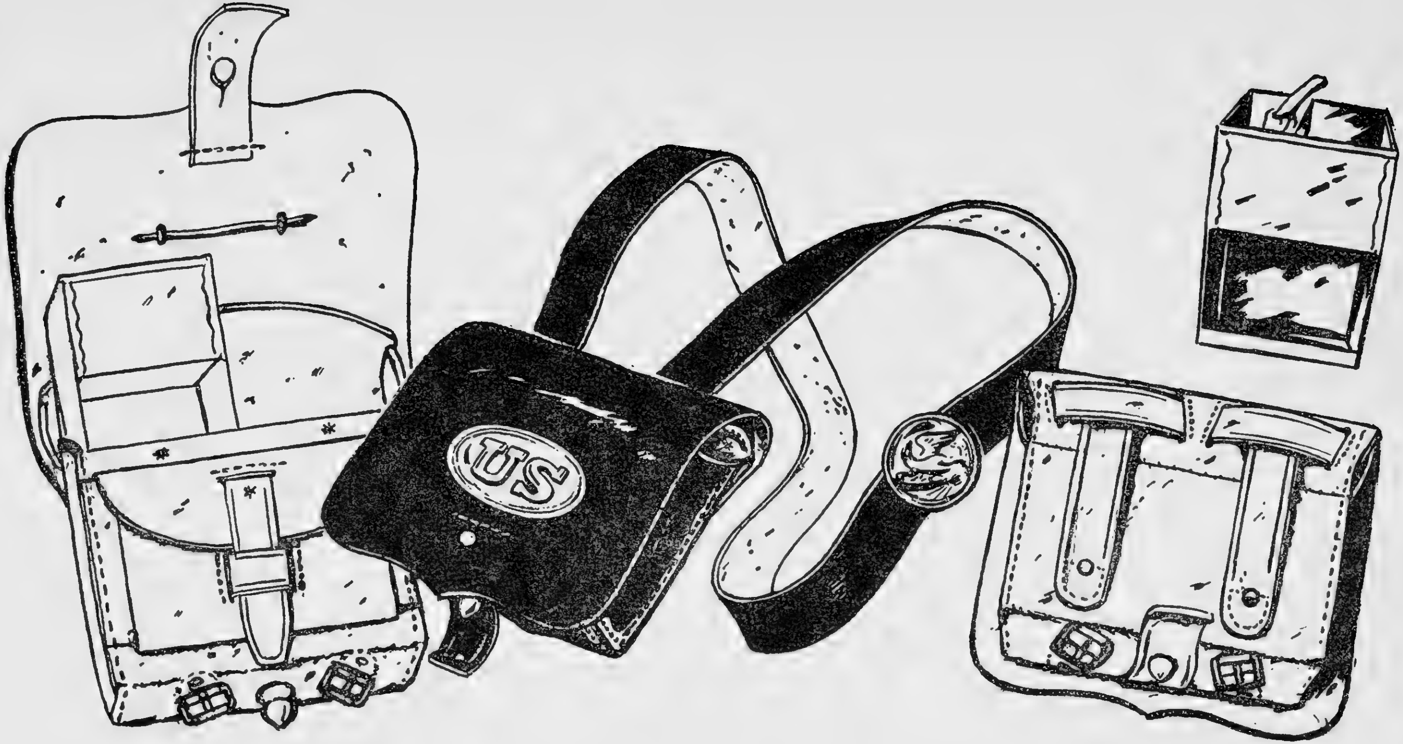

Fig. 14.—Cartridge box for Model 1855 rifle. (R. L. Miller.)

the flap open. It contained a wire pick for clearing the nipple. This pouch was also used to carry the combustible revolver cartridges.

During the war the Mann box was introduced. In this the tin box within contained a tray sliding up and down, on which the cartridges were placed when the box was filled. This tray was pulled up as the cartridges were used, thus avoiding the inconvenience of transferring between the tins as in the regulation box. Two of these were worn

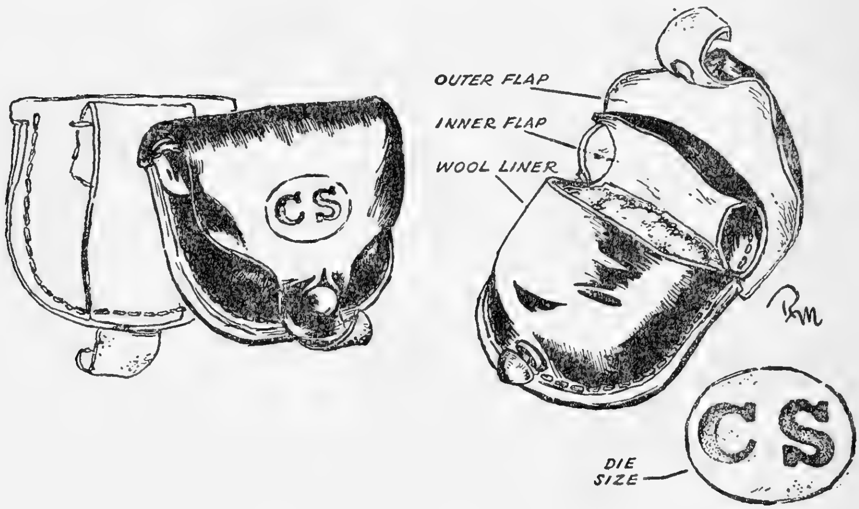

FIG. 15.—Confederate cap box. (R. L. Miller.)

in front to counterbalance the knapsack in the rear. The Blakeslee box was used for the Spencer carbine. It consisted of a hexagonal block of wood, about 12 by 4 by $2\frac{1}{2}$ inches, encased in leather, and containing 10 to 13 tin tubes full of Spencer cartridges—seven in each. The contents of one of these could be emptied at once into the magazine of the carbine. The case had loops and rings by which it was attached to the equipment. Special cartridge boxes were supplied for the various nonstandard cartridges in service. Burnside, Sharps, Smith, Merrill, Warner, and other boxes were used. (See Appendix 7.)

From time to time detachable shoulder stocks for United States pistols or revolvers have been issued. Some of the 1818 Springfield pistols were equipped with this device (probably unofficially), and other later models are found with what appear to be experimental extension stocks. In 1855 one of these was standardized for use with the weapon designated the "pistol-carbine." This arm, with its long

barrel and folding sight leaves, was really more carbine than pistol, akin to the "paratrooper carbines" of a later period. Similar stocks, with various methods of fastening, were issued with some "Army" and "Navy" Colt revolvers. The intention was to supply one extension stock with each pair of revolvers. The Ordnance board which recommended their use stated, in part:

> The board consider Colt's pistol-carbine, Colt's pistol with breech attachment, superior for our cavalry service to any arm with which they are acquainted. The board recommends the adoption of Colt's pistol (with the breech attachment) and ammunition for the cavalry service; and that each trooper be furnished two pistols adjusted to the same breech, the barrel of each pistol to be eight inches long, of the caliber of the army revolver.[83]

In 1858 the Ordnance Department purchased 924 Colts dragoon pistols with 462 Colts pistol stocks at a contract price of $50 per pair with stock. These, plus four ordered in 1859, were the only stocks for the holster pistol that the Army procured, though they were sold commercially. During the Civil War, extension stocks were used extensively with the "New Model Army" (1860) pistol.

From the first mention of riflemen in the United States Service, knives and tomahawks were listed as accoutrements of more or less standard issue. In a letter to Gen. J. S. Smith, George W. P. Curtis described riflemen of the Revolutionary Period as follows: "Riflemen of Morgan's Regiment wore . . . Blue & White uniforms, hat turned up at the side with Bucks tail—Belt, tomahawk & knife—on the colors of the Rifle Corps, were the Tomahawk, instead of a spear." Tomahawks were carried on arsenal inventories and were issued to troops during Wayne's campaign in 1792, to the Lewis and Clark Expedition, and later to troops during the War of 1812. The tomahawk was used by most militia and other troops on frontier duty. Several arsenals and depots still had them in stock in the 1830's.

The original tomahawk used by the North American Indians of the eastern seaboard was a wooden club having for a head either a plain knot or a knob fitted with one or more metal or flint spikes. The rifleman's tomahawk was a light camp ax or hatchet of the size then known as a "half ax." Such hatchets were used in Europe by engineer and sapper troops. The type used in the United States Service is illustrated on plate 22a. This example is like several found at Ticonderoga. It is marked "Baldenberg"—like most of those used here it was made in Europe. A large figure "2" is stamped into the metal. This might indicate issue to the Second Rangers, a unit armed with rifles. Hatchets of this general type were very popular with the Indians, to a large extent taking the place of their wooden tomahawks

and becoming an important article of trade. Plate 22b shows a trade type of the late eighteenth century. Others had a tobacco pipe for a poll. Hatchet heads of British, French, and Spanish design can be identified in collections of Indian material. These were mostly imported, but some were copies by local blacksmiths.

The knives first issued to riflemen were described simply as "butcher knives." They had plain wooden handles and 8- to 10-inch, thin, flat, single-edged blades, about 1 to 1½ inches wide. Later the Army tended to follow the pattern made famous by James Bowie. Plate 22c shows an example of such a knife, made by contractor A. G. Hicks, cutler and toolmaker of Cleveland, Ohio. It is likely that this knife was made for the Allegany Arsenal at Pittsburgh, during the period 1830-40, when procurement of Ordnance supplies for the region west of the Alleghenies was centered there. The only reference to Hicks near that time, in the Cleveland Leader of March 18, 1859, seems to be late in his life: "The Forest City and Pike's Peak Company left town last evening on the steamer, May Queen, en route for the gold regions. They are men of the right stamp to succeed. Commander-in-chief, Andrew G. Hicks, Esq., is a man of much general information. Being an old traveler, he is eminently qualified to direct an enterprise of this description."

Another somewhat heavier knife was made under contract by N. P. Ames, of Cabotsville, Mass. This knife, shown on plate 22d, is also double-edged toward the point. Correspondence between the Ordnance Office and Springfield Armory, in February and March 1849, provides some details about the Ames contract, as follows: "The mounted riflemen are to be furnished with heavy sheath knives . . . 1000 sheath knives have been ordered from Mr. Ames. Their early completion is to be urged and the price to be adjusted by Major Ripley. . . . The pattern which has been adopted for the sheath knives has been forwarded by Mr. Mosman." (This may have been the Mosman of the firm Morrill, Mosman, & Blair, which made some of the Elgin cutlass-pistols.) The Ames knives are said to have been intended originally for the Frémont expedition, but as they were not delivered until 1849 they were too late. They would have been handy for cutting kindling or other campaign chores but seem inferior to the Hicks blade for skinning or fighting. Perhaps the backwoods maker had a more practical viewpoint or better advice than a New England competitor. The latter did a more refined design job, as to fabrication.

Another somewhat similar knife, marked "Collins and Co. Hart-

ford," is shown on plate 22e. It was probably made between 1850 and 1865. The single edged blade is of a pattern that was followed, in general, until the 1880's, when the last type of rifleman's knife was made at Springfield Armory. The Collins knife is stampel "1st N.Y.F." on the handle, presumably an issue mark.

During the Civil War a Bowie-knife bayonet was provided for the Navy "Dahlgren" or "Plymouth" rifle (pl. 22f). The idea was still alive as recently as 1900, when a Bowie-bayonet was made for the Krag-Jorgenson rifle, for use in the Philippines. Once the troops on frontier duty were out of the woods, the need for a heavy knife as a secondary weapon and camp tool was no longer so urgent. In the actions of formal warfare, the knife could not compete with the effective rifle musket, though it died hard. The Richmond Daily Examiner, on August 13, 1861, carried the following news item: "The Tiger Rifles, Wheat's Battn, charged with Bowie knives at Manassas. But 26 out of 83 rank and file survive." At the beginning of the war, quite a number of Confederate volunteer units had carried knives, probably to make up for deficiencies in primary weapons, or ammunition shortage.

MANUAL OF ARMS—LOADING AND FIRING

During the Revolutionary War the musket was loaded and primed in 15 counts or motions. It then required six more counts to cock, aim, and fire, a total of 21 motions altogether.[84] By 1836 the loading was reduced to 12 counts, but the firing was still done in 6. Fifteen commands were required: LOAD, OPEN PAN, HANDLE CARTRIDGE, TEAR CARTRIDGE, PRIME, SHUT PAN, CAST ABOUT, CHARGE CARTRIDGE, DRAW RAMMER, RAM CARTRIDGE, RETURN RAMMER, SHOULDER ARMS, READY, AIM, FIRE.[85] With the change to the percussion system the loading operation became considerably simplified.

During the Civil War the loading operation was accomplished in ten counts. The successive commands were: LOAD, HANDLE CARTRIDGE, TEAR CARTRIDGE, CHARGE CARTRIDGE, DRAW RAMMER, RAM CARTRIDGE, RETURN RAMMER, CAST ABOUT, PRIME, SHOULDER ARMS. This required 14 motions and firing called for 3 more.

For practical purposes the minimum time required to load and fire a percussion muzzle-loader was 15 to 20 seconds, of which about 14 seconds was consumed in loading. As the time spent in loading was lost, reduction of this was a major basis for improving the efficiency of firearms.

The first breechloaders were single loading, that is, each cartridge

had to be inserted manually, requiring on the average 6 motions. With such actions 10 shots per minute could be fired. Allowing aiming time of 1 second per shot, this cut lost time to 5 seconds per shot. In the case of the Spencer, 4 motions were needed, and 15 shots per minute could be delivered. This reduced the time lost to 3 seconds per round. Finally, with the Henry, 20 to 30 rounds per minute could be fired, using only two motions in loading. With this arm for the first time less time was required to load than to aim.

In order to evaluate the various arms used by American troops in years past some knowledge of their relative capabilities is necessary. As personal observation is the most reliable source for such data, the student is considerably handicapped, for the passage of time has erased most first-hand information. However, certain printed testimonials and reports of tests can still be found.

NOTES

(See Bibliography for full literature citations)

1. Mass. Hist. Coll., vol. 9: 264.

2. Hist. Amer. Mfr.

3. The first matchlock muskets used in the English army during the reign of Elizabeth bore her initial "E" on the lock. Then, as in the succeeding 250 years, muskets had a brown finish. English musketeers gave the nickname "Brown Bess" to their weapons for these reasons. However, Lord Cottesloe (The Englishman and his rifle, London, 1945) says that "Bess" is the same word as buss, as used in arquebus, blunderbuss, and the like.

4. On March 19, 1778, Congress authorized "cartridges made with ounce balls . . ." (for the caliber .69 musket).

5. Leg. Hist.

6. to 9. *Ibid.*

10. Hist. Amer. Mfr.

11. *Ibid.*

12. Pennsylvania Archives, IV: 712; Col. Rec. X: 506.

13. Pennsylvania Archives, IV: 708, 712, 717, 777; VI: 453, 475, 633.

14. Coxe, View of the United States.

15. Amer. Archives, 5th ser., vols. 1 and 3.

16. American Archives, 4th ser. vols. 3-5; 5th ser., vol. 1.

17. Olmstead, Denison, Memoirs.

18. Bruce, Kathleen, Virginia iron manufacture in the slave era, pp. 112-114, 131.

19. Amer. Archives, 4th ser., vols. 1, 3, and 5.

20. Leg. Hist. Pliarne, Penet, & Cie. were French agents for U.S. arms purchases. Possibly Penet, Windel, & Co. simply acted as agents for some of these French arms purchased abroad.

21. *Ibid.*

22. *Ibid.*

23. Duane.

24. Leg. Hist.
25. American Rifleman, Feb. 15, 1924.
26. Leg. Hist.
27. Senate Doc. 185, 24th Congress, 1st Session, 1836.
28. Ord. Man. 1841. Model dates given are those established by official contemporary ordnance publications.
29. Under the Act of 1808, for arming the militia.
30. Rep. Exp. Gunpowder.
31. For details of these and other U.S. small arms, refer to: The breechloader in the service, Claud E. Fuller; Springfield shoulder arms, Fuller; U.S. Ordnance, vols. 1 and 2, Lt. Col. J. E. Hicks; U.S. martial pistols and revolvers, Col. Arcadi Gluckman.
32. MSS. Ordnance contracts, National Archives.
33. Reports of experiments with small arms, Washington, 1856. Hereafter cited as Small Arms, 1856.
34. *Ibid.*
35. Ord. Man. 1861.
36. Dahlgren, J. A., Boat armament of the U.S. Navy. Hereafter cited as Dahlgren.
37. A "Plymouth" rifle, made at Harpers Ferry in 1854, may be seen in the U.S. National Museum. No doubt it is a pattern arm.
38. MSS. Ord. contracts, National Archives.
39. Ord. Reg. 1841.
40. Leg. Hist.
41. MSS. Ord. contracts, National Archives.
42. Ord. Rep., vol. 1, letter, Jan. 22, 1822.
43. Journ. Franklin Inst., vol. 73, p. 282, 1862.
44. Ketland of London had a branch shop in Philadelphia at the time.
45. Satterlee, C. F., Catalog of firearms. Hereafter cited as Satterlee.
46. Sawyer, C. W., Firearms in American history, pl. 28.
47. Patent Office List No. 3384X.
48. Abstract of existing contracts as of Jan. 7, 1829. National Archives.
49. Hicks, James, U.S. Ordnance, vol. 2.
50. For further details on the Wheeler guns see Captain Wheeler's revolving guns, by Lt. Col. B. R. Lewis, American Rifleman, Apr. 1953.
51. Spaulding, G. W., Japan and around the world. New York, 1855.
52. For further details about the early Colt arms in the Service, see Sam Colt's repeating pistol, by Lt. Col. B. R. Lewis, American Rifleman, May and June 1947.
53. Sum. St. Purch. & Fab.
54. Catalog of the arms and accoutrements of the Springfield Armory Museum, 1909.
55. Purchase and fabrication of ordnance stores, Ord. Rep., vol. 2.
56. Ord. Reg. 1834.
57. This is readily detected, as the flint action obstructs the carbine sights. The M1819 Hall's rifle had offset sights, though the 1817 contract Hall did not.
58. Ord. Rep., vol. 1.
59. Benton.
60. Dahlgren.
61. The War of the Rebellion: A compilation of the official records of the

Union and Confederate Armies, Washington, 1880-1901. Hereafter cited as Off. Rec.

62. Satterlee.

63. Several other carbines used were noted as employing "peculiar ammunition, not adapted to interchangeability."

64. Ord. Memo. No. 5, 1864.

65. Demmin, August, Die Kriegswaffen, Leipzig, 1886.

66. WD letter 1263, Aug. 28, 1845.

67. For details of Confederate arms see Firearms of the Confederacy, by Fuller and Steuart, Huntington, W. Va., 1944. Hereafter cited as Fuller & Steuart.

68. Mil. Comm. to Europe.

69. Senate Doc. 72, 37th Congress, 2d Session, Report of the Commission on Ordnance and Ordnance stores made to the War Dept.

70. *Ibid.*

71. Fuller & Steuart.

72. Sum. St. Purch. & Fab.

73. Calibers are taken from "Instructions for Quarterly returns of Ordnance and Ord. stores," Washington, 1863, publ. as Ord. Memo. No. 1.

74. Leg. Hist.

75. *Ibid.*

76. Duane.

77. Catalog of the Ordnance Exhibit at the Philadelphia Centennial of 1876, Philadelphia, 1876. Hereafter cited as Cat. Ord. Exh.

78. Ord. Reg. 1834.

79. House Doc. 107, 24th Congress, 2d Session, 1837.

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82. Benton.

83. Busk, Hans, The rifle and how to use it.

84. Rules for the order and discipline of the troops, 1779. See Appendix 7.

85. Regulations for the Militia and Volunteers, 1836. See Appendix 10.

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Chapter IV

PERFORMANCE OF SMALL ARMS IN THE UNITED STATES SERVICE

In comparing the performance of the various types of small arms used in America prior to 1866 a general understanding of the many sources of error in the fire of such weapons is helpful. Most of these errors affect muzzle-loaders and breechloaders alike. Many obvious sources of deviation in firing may be found in the construction of the arm. These troubles may or may not be readily correctible. The errors derived from wrong position of the sight, inexact caliber, imperfect barrel, excessively hard trigger pull, and windage may be remedied. Those arising from such causes as recoil and barrel vibration are more difficult to overcome. These last are especially troublesome in breechloaders having asymmetrical support of the breech closure.

The powder charge is another common source of trouble. Variations in results may derive from inexact measure, difference in granulation or in powder quality, deterioration from dampness, variation in ramming, sticking of powder grains along the bore (from fouling or dampness), and accumulation of fouling or dirt.

Deviations attributable to the ball may involve inexact weight or caliber, deformation in loading, or instability caused by the center of gravity not being in the geometric center (this may result from lack of symmetry in the mold or air pockets in the lead).

Finally, atmospheric conditions beyond the control of the shooter may have a marked effect upon the accuracy of fire. Some of the more noticeable ones are wind, temperature, and air density and humidity. The results are often changed when the sun is in a different position, or when the gun and target are at different levels.

When it is realized that all or potentially all these sources of error plagued the soldier who used the smooth-bore musket, it is not hard to understand how that arm got its reputation for almost incredible inaccuracy.

Many improvements came about by accident. For example, the French rifled some old muskets which had previously been reamed out to handle a larger ball. That operation had left the wall of the

barrels rather thin, and so when they were worked over for the second time the rifling cuts were made shallower at the muzzle, becoming deeper toward the breech. Much to everyone's surprise, this method proved to produce more accurate results and was adopted for all French arms.[1]

The British "Brown Bess" musket, used extensively by American troops during the Revolutionary War, was about the worst of the lot. Describing it, Busk says:

> The Brown Bess [was] the very clumsiest and worst contrived of any firelock in the world. It required the largest charge of powder and the heaviest ball of any; yet owing to the absence of every scientific principle in its construction, its weight and windage were the greatest, its range the shortest, and its accuracy the least; at the same time that it was the most costly of any similar arm in use, either in France, Belgium, Prussia, or Austria . . . taking a long series of engagements, only one musket ball out of 460 was found to take effect.

There was practically no change in the British musket between 1776 and 1812. The first report of "the Association for Promoting the Defense of the Firth of Forth and Scotland in General" in commenting on target practice, said; "Every fifth or sixth shot is made to take place in a target of three feet diameter at about 100 yards. This with the common battalion firelock, is a high degree of precision. . . ."[2] Writing in 1814, Colonel Hanger, a British army officer, said, "A soldier's musket, if not exceedingly ill-bored (as many are) will strike the figure of a man at 80 yards; it may even at a hundred, but a soldier must be very unfortunate indeed who shall be wounded by a common musket at 150 yards, provided his antagonist aims at him; and, as to firing at a man at 200 yards, with a common musket, you may just as well fire at the moon. No man was ever killed by a musket at 200 yards by the person who aimed at him." Official tests of the Brown Bess show that at "point blank"[3] range (75 yards, with the barrel held horizontal) the balls struck the ground at distances varying from 116 to 218 yards. At 100 yards there was 4 feet 8 inches vertical and a greater horizontal dispersion. At 200 yards the vertical spread was 9 feet 4 inches, and the horizontal so great it could not be determined accurately.[4] "One went high, and one went low, and where in Hell did the other one go?"

In 1650 the length of the French musket barrel was established as 46.8 inches. The ordinance introducing the fusil into French service, in 1670, retained this length, and it was continued until 1763. With the model of 1763, the barrel was shortened to 44.7 inches to facilitate loading by men of average height. This remained standard until 1822, when the barrel length was further reduced to about

43 inches.[5] One of the major disadvantages of these long muzzle-loaders was that it was next to impossible to load them in the prone position; hence a soldier made a fine target during the complicated loading process. As a result, he hurried it as much as he could, frequently putting the load in backward or forgetting to remove his ramrod from the barrel before firing.

The French conducted the first consistent program of research and development and operations research on small arms. They made numerous experiments to determine the characteristics of their firearms and to point out possible lines of development. On the basis of many wars they estimated that out of 10,000 cartridges supplied only one reached the enemy.[6] The French musket of about 1800 was sighted for 120 meters (131 yards). The official instructions for aiming were as follows:

To strike a man in the center of his body, up to 100 meters aim at his chest; 100-140 at the height of his shoulders; 140-180 at the height of his head; 180-200, at the top of the head-dress; over 200, aim over the head-dress (estimated).

Four to five degrees of elevation reaches 600 meters, and to 1,000 at higher angles. But beyond 400 meters, the velocity is too low to make dangerous wounds, and [the effect of fire] uncertain beyond 200. The cavalry musketoon is sighted for 200 meters, but is uncertain at this range. Aim direct up to 70 meters, from 70-160 aim at the height of the knees. As the pistol has a very short effective range, the cavalryman aims directly at the point he expects [hopes?] to hit.[7]

The number of shots reaching the target, directly or by ricochet, varies with the nature of the ground before the target. If the ball encounters hard and uniform soil, it will ricochet, preserving a large part of its velocity. If the soil is soft and irregular, but a small part of the balls will preserve either velocity or direction. Against a target two meters high, it may be expected that from Infantry Fire, the balls striking by ricochet on uniform soil will equal 1/7 of those hitting direct.

A table shows the results obtained by firing 100 shots at each of several ranges at a target representing a rank of infantry—1.9 meters high by 32 meters long:[8]

Range	78.5 m	157 m	235.5 m	314 m	392 m	471 m
Direct hits plus ricochets	75	50	27	20	14	7
Direct hits only (uneven ground)	67	38	16	6	3	5
Passing through 1-inch pine board	75	50	25	11	5	1

It is seen that to the third distance, nearly all the balls passed through the pine boards of the target, both direct hits and ricochets. The second distance, near the point-blank range, is a good effective range for the musket. At 400 m. the fire is not effective. A rank of men does not cover half the area of such a target as the above, so that the effect of fire against a firing line should be reduced accordingly.[9]

The following table shows the probability of fire with smooth-bore French arms, in terms of the number of balls per hundred fired which strike the target:[10]

Arm	Size of Target Height	Width	100 m	150	200	250	300	400
Infantry musket	2. m	2. m	...	31.8	15.5	5.0	1.75	.37
Dragoon musket	2. m	.57 m	23.2	11.2	6.8	...	5.9	...
Dragoon musket	1.6 m	16.6 m	55	43	43	...	16.3	...
Musketoon, Gendarmerie	3. m	3. m	90	70	...	...	...	...
Musketoon, Artillery	1.78	.57	18.7	3.2	...	...	...	...
			20 m	40 m	60 m	100 m		
Pistol	1.9 m	1.2 m	68	34	22	10		
Pistol largest error	....	....	4 m	5 m	6 m	10 m		

From horseback, only 7.3 percent of the pistol shots hit the target. Time to charge, aim, and fire was one half minute. The rate could be increased to three per minute, but at the expense of proper aiming. Examining the table, it is seen that the balls lose most of their effect when the range is increased. At 350 meters, only $\frac{1}{6}$ of the shots reached a target the size of an infantry division. As the ball does not fit the bore tightly, the line of flight on which it leaves does not necessarily correspond with the axis of the bore, inclining to one side or the other, depending on which side was the last struck. The ball also acquires rotation from contact with the side of the bore, also depending in direction on the last side struck. This not only reduces velocity, but causes drift in an unpredictable direction.

Robbins was the first to attribute error to rotation acquired from contact with the side of the bore.

In 1817 and 1818 experiments were conducted at Metz to determine the influence of reducing windage on the accuracy of fire. (We got to this in 1846.) It was found that a tighter fit gave less deviation and a little greater velocity. The table shows the number of musket balls striking a 2-meter square per hundred rounds fired:[11]

Balls/Lb.	Range	100 m	125 m	150 m	175 m
20	......	88	79	65	46
18 (44.7″ bbl)	......	92	83	68	30
17	......	95	85	70	52
20 (29″ bbl)	......	59	46	29	14
18	......	68	54	38	21
17	......	77	64	45	26

During the Revolutionary War the British claimed that American riflemen could hit a man wherever they liked at 200 paces. In the official Handbook for Riflemen published in 1813[12] the instructions for training clearly indicate that the rifles were accurate at considerable range. A target 5 feet in diameter was prescribed for recruit training to avoid having new men become discouraged by missing the target. The ranges for this practice were up to 300 yards, at which

distance a 5-foot target does not look very big. The shooter was to determine the proper load for his rifle and then attach a measure for that exact quantity to his "flask." Elsewhere the term "horn or flask" was used. (This seems to put the use of flasks about 20 years earlier than had been thought likely.) As a rule of thumb one-fourth to one-fifth the bullet weight (43 to 55 grains) was suggested as a proper charge for 250 to 300 yards, and larger loads for ranges of 500 to 700 yards. The rifleman was to suit his load to the range and habitually loaded from the pouch and flask. The fixed paper cartridge for the rifle (100-grain charge) was used only for service in close order, when firing by command. This was not normal tactics for rifle corps. It was stated that "riflemen must be practiced to load and to fire as they lie on the ground."

Few early records of formal American arms tests exist. In 1826, when the first of the Harpers Ferry Hall's rifles were issued to troops, trials were conducted to determine the relative rates of fire of the various arms then in use. While the Hall's rifle was being fired 100 times, the common rifle was fired 43 rounds and the musket but 37. One of the first extensive tests was conducted from March to June 1837, at West Point, N. Y., then a Government arsenal. Rates of fire and penetration of various projectiles were determined. The rate of fire for the flintlock musket was 2.53 shots per minute. Its penetration in white oak (the material used in all this series) with the service load was 1 inch at 100 yards, 0.55 inch at 200, and zero at 300, though a shallow dent was made. Ten shots were fired at each range. The standard buck-and-ball cartridge was fired at the rate of three shots per minute. In nine shots, 16 out of 27 buckshot hit the target at 80 yards. At 9 yards, the ball penetrated 1.15 inches and the buckshot 0.41 inch.

The flintlock muzzle-loading rifle gave a penetration of 0.94 inch at 100 yards, 0.29 at 200, and zero at 300. At the last range the balls rebounded, leaving a 0.2-inch dent. Ten shots were fired at each range. The percussion Hall's musket with 86-grain charge gave 0.83-inch penetration at 50 yards, 0.34 at 100, 0.07 at 150, and zero at 200. With 110-grain charge (maximum chamber capacity) the penetration at 10 feet was 1.8 inches. Ten shots were fired under each condition. The flintlock Hall's musket, with 100-grain charge, was fired 10 shots in 2 minutes and gave 1.07 inches penetration at 10 feet. The Hall's rifle, with 70-grain charge, was fired at the rate of 3.56 shots per minute. Penetration was 0.63 inch at 50 yards, 0.93 at 100, 0.40 at 150, and zero at 200.

Colt's revolving rifles and muskets were also tested. A number of

these were used during the Florida War. Writing to Samuel Colt, in 1840, First Sergeant P. W. Henry of the Second Dragoons, remarked upon the performance of the Colt's rifles in Florida:

> Although the arms were of an extremely light and fancy make, yet they were found to be durable; and there was not a man in the whole detachment that did not feel himself of five times the force with one of your *repeaters* than with the common carbine or musket. . . . There being a variety of calibers among them, I found some little trouble at first by getting the balls mixed, and thereby causing some difficulty in loading . . . firing at a thick oak plank one hundred yards distant, every ball penetrated about two inches . . . a greater part hit within two inches of the center . . . Each man having two receivers, they were placed in the rifles and discharged in one minute.[13]

From the reference to the extra cylinder, the rifles just described must have been the first, or ring-trigger, 8-shot type. Soon thereafter some of the later, 6-shot, hammer-type carbines were tried. In a letter written to the Secretary of War on November 4, 1841, Captain Mordecai said, in part, concerning tests of these arms:

> In six different cases two charges from the same receiver went off at once, that the receiver is often carried by the machinery which moves it, beyond the point of coincidence with the barrel and that the machinery is very apt to be obstructed in its action by fragments of the percussion caps, all of which circumstance would be very objectionable and dangerous in action.
>
> Captain Sumner, the commanding officer at Carlisle, reports that 'the first time the Carbines were used by the guard, all the loaded chambers went off at once. . . .' He considers them unsuited for military service.

Concerning the similar rifled carbines furnished the Navy in 1841, the following item appeared in the National Intelligencer for January 11, 1842:

> The St. Augustine (Fla.) News says that 'after the return of the Navy expedition from the Everglades, the Marines, who were armed with Colt's rifles, in discharging their pieces, had five cylinders and two barrels to burst, breaking the leg of one man.'

A continuing search was being made in the attempt to combine in one arm the accuracy of fire of the rifled barrel with the speed and ease of loading of those loaded either at the breech or with a loose-fitting ball. The first breechloaders did not, when fouled from firing, offer sufficiently solid construction and ease of manipulation. About 1840 the United States Army started to experiment with conical balls. At first it seemed impossible to avoid a loss of velocity because of the great reduction in the weight of the charge necessary in the rifled musket. This was to hold the recoil with the heavier bullet down to that of the musket. With the rifled musket, practice was conducted

up to 1,000 yards, whereas the smooth-bore percussion musket was effective only to 300 yards in a general action and useless beyond 400.

In 1843 and 1844, after installation of our ballistic pendulum, Captain Mordecai made extensive tests at the Washington Arsenal. Though Mordecai was concerned principally with testing powder and cannon, he recorded the first accurate velocity measurements of our small arms as follows:

Arm	Type Lock	Model	Bore Diam.	Bbl. Length	Windage	Net Charge	Vel. Ft./Sec.
Cadet's Musket	Flint	old 1830	.57	35.5	0.045	70	1690
Common Rifle	Perc.	1841	.54	32.5	0.015	100	2018
Common Rifle		....	...	....	....	70	1755
Hall's Rifle	Flint	1826	.52	35.1 [1]	0	70 [2]	1490
Hall's Carbine	Perc.	1840 (North)	.525	23.38 [1]	0	70 [3]	1240
Jenks' Carbine	Perc.	1844	.52	24.25	0	70	1687

[1] Chamber included.
[2] Chamber holds 75 grains with the ball.
[3] Normal load 100 grains—70 used to compare with the Jenks'.

In the Jenks carbine, nearly the whole force of the charge was exerted on the ball, giving it a velocity equal to that of the ball from the Cadet's musket, despite the great difference in the lengths of their barrels. In Hall's arms, the loss of force, by the opening between the chamber and barrel, more than offset the advantage of the tight-fitting ball, so that a given charge gave the ball from a Hall rifle much less velocity than that from the common rifle loaded with patched ball.[14]

Comparative tests of muskets with varying windage were made. With the regulation flint-musket charge of 130 grains (including 10 of priming) and with a 0.64-inch ball of 397.5 grains (18/lb.) a velocity of 1,499 feet per second was obtained. With a percussion musket using a 110-grain charge and a 0.65-inch ball of 411.5 grains (17/lb.), 1,508 was indicated. The drop of this ball was 7.7 inches at 80 yards, 23 at 120, and 32 at 150. A test of the then new percussion pistol of caliber 0.54 gave a velocity of 947, with 35 grains of powder and a 0.525-inch, 218.5-grain ball (32/lb.) wrapped in its cartridge paper. This ball penetrated 1 inch of pine at 80 yards; this was considered the equivalent of a disabling wound.

It was observed that a reduction of windage of 0.01 inch was equivalent to an increase of 10 grains in the powder charge. Based on this observation compressed balls were recommended instead of the cast ones then used, as their greater uniformity would permit a tighter bullet fit. Percussion ignition was proved more efficient than flint, giving 14 to 24 feet per second more velocity. This was tested by fitting a percussion nipple to a flintlock musket, so that the loss of pressure through the flint flashhole would be a constant factor.[15]

Between 1853 and 1855 extensive tests were made at Harpers Ferry and Springfield Armories to determine the relative merits of

various types of bullets, rifling, and systems of expanding the ball. One of the conclusions reached was to reduce the diameter of the bore to 0.58 inch, as the elongated bullet in the musket caliber (0.69) was too heavy, and the old rifle caliber (0.54) bullet though good at 200 yards did not hold up well at the longer ranges. It was decided also to make the ball fit the bore snugly without a patch and to achieve the necessary expansion by hollowing the base as this had been found better than using compound balls. No patch or paper was used on the ball; a wax and tallow coating made loading easy. It was observed that coarse-grained (musket) powder gave better results than rifle powder, providing more regular action on the ball and causing less fouling.[16]

The series of tests continued, with machine rests used to determine the relative accuracies of various small arms. The caliber 0.69 percussion musket was fired with service load at a 30-by-15-foot target. Three out of 25 shots at 300 yards missed this; the rest made a group with mean vertical and horizontal deviations of 42 and 70 inches, respectively. The same number of shots at 400 yards gave 20 misses (80 percent); the few that struck had both vertical and horizontal mean deviations of 51 inches.

The regulation rifle, with service charge (70 grains) and spherical ball, was fired at an 8-by-8-foot target. At 200 yards 3 out of 25 shots missed; the rest had mean vertical and horizontal deviations of 12.1 and 13.2 inches. At 300 yards there were only 6 hits in 25 shots. Those that struck the target had vertical and horizontal deviations of 15.5 and 32 inches.

The following were the characteristics of other rifled arms tested:

Model 1842 Rifled Musket, with 70 grains of powder and 658 grain, 0.685-inch conical ball. Twenty-five shots were fired at each range.

Range	Elevation	Drift to right	Vert. Dev.	Hor. Dev.	Missed
200 yards	30 minutes	10 inches	8.9 inches	5.8 inches	0
500 yards	1 deg. 45′	54 inches	24.0 inches	17.7 inches	0
1000 yards	4 deg. 45′	562 inches	27.6 inches	55.2 inches	13

British Model 1851 Enfield Musket, with 60 grains of powder and 530-grain Pritchett ball. Twenty-five shots were fired at each range.

Range			Vert. Dev.	Hor. Dev.	Missed
200 yards	....	....	7 inches	11.3 inches	0
500 yards	....	....	20.4 inches	17.6 inches	0
1000 yards	....	....	42.0 inches	52.8 inches	10

Cavalry Pistol, caliber 0.54, with 8-inch barrel, with 30 grains of powder and 390 grain ball. Twenty-five shots at each range.

Range			Vert. Dev.	Hor. Dev.	Missed
100 yards	....	....	6.4 inches	4.3 inches	0
200 yards	....	....	12.0 inches	12.0 inches	0

The board wished to standardize a single bullet for all arms, but because of the small charge used in the pistol there was not enough expansion of the musket ball, and so a special lighter one had to be used. This was also employed in the cadet musket. The recommendations of the board were: To adopt the caliber of 0.58 for all small arms; to standardize the musket barrel at 40 inches, the musketoon at 26, and the pistol at 10; to adopt rifling with three grooves of decreasing depth, with one turn in 6 feet in the musket and musketoon, and one in 4 in the carbine and pistol; and to enlarge the old rifles to caliber 0.58. On July 5, 1855, the Secretary of War approved the following model designations: [17]

0.69 inch rifle-musket, model 1822, altered
0.69 inch rifle-musket, model 1842, altered [1]
0.58 inch rifle-musket, model 1855, new
0.58 inch rifle, model 1841, altered [2]
0.58 inch rifle, model 1855, new
0.58 inch pistol-carbine, model 1855, new.

[1] Differs from the original model (1840) as follows: Bore grooved, rear sight similar to that for new musket, Maynard lock, portion of breech cut off and new breech piece with cone seat added.
[2] Reamed up and re-rifled, with 1855 type rear sight, and bayonet stud.

The characteristics of the new arms were determined by firing from rests.

Rifle-musket, with 60-grain powder charge and 500-grain bullet.

Range (yards)	No. Shots	Elevation (degrees and minutes)	Vert. Dev. (inches)	Horiz. Dev. (inches)
200	50	0–20	4.4	3.4
300	50	0–40	9.0	7.3
400	50	1–05	11.2	9.4
500	50	1–30	17.4	14.4
600	50	2–00	24.6	13.8
700	50	2–20	28.8	19.9
800	53	2–50	37.1	18.9
900	84	3–30	52.8	24.8
1000	120	4–15	55.9	25.5

Altered Rifle, with 60-grain powder charge and 500-grain bullet.

Range (yards)	No. Shots	Elevation (degrees and minutes)	Vert. Dev. (inches)	Horiz. Dev. (inches)
200	50	0–25	3.9	3.7
300	50	0–50	7.9	1.0
400	50	1–10	11.8	11.0
500	50	1–45	15.0	12.7
600	50	2–10	18.6	14.4
700	48	2–35	25.2	16.2
800	49	3–00	37.8	17.4
900	86	3–40	52.4	20.0
1000	120	4–30	58.0	25.2

Altered Musket, with 70-grain powder charge and 730-grain bullet.

Range (yards)	No. Shots	Elevation (degrees and minutes)	Vert. Dev. (inches)	Horiz. Dev. (inches)
200	50	0–30	5.7	5.2
300	50	1–00	4.9	4.6
400	50	1–30	15.6	12.7
500	50	1–50	15.6	11.9
600	50	2–15	24.6	16.0
700	50	2–50	28.8	15.6
800	50	3–15	35.4	27.5
900	50	4–10	55.2	29.4
1000	50	4–50	61.2	26.4

Pistol-Carbine, with 40-grain powder charge and 450-grain bullet.

Range (yards)	No. Shots	Vert. Dev. (inches)	Horiz. Dev. (inches)
100	50	3.6	3.2
200	50	7.6	6.4
300	50	19.9	10.7
400	50	30	13.2
500	50	32	18.6
600	52	(23 shots hit a target 16 feet high and 24 feet long.)	

The penetration in 1-inch pine boards was as follows, using the same charges as before:

Arm	Range in Yards		
	200	600	1000
Altered Rifle	$9\frac{1}{3}$	$5\frac{2}{3}$	$3\frac{1}{2}$
Altered Musket	$10\frac{1}{2}$	$6\frac{1}{3}$	3
New Rifle-Musket	11	$6\frac{1}{3}$	$3\frac{1}{4}$
Pistol-Carbine	$5\frac{3}{4}$	3	..

The heights of points along the trajectories were determined:

Arm	Range (yards)	Height in Inches at Distances in Yards					
		50	75	100	125	150	175
Rifle-Musket	200	14.5	17.7	19.3	19.7	16.0	10.0
Altered Musket	200	16.2	18.8	19.7	20.9	17.5	10.4
		100	200	250	300	400	500
Harpers Ferry Rifle [1]	500	85	141	145	150	97	0

[1] With 40-grain powder charge and 400-grain bullet.

It was found that the highest point on the trajectory of the pistol-carbine at 100-yard range was 12 inches; that of the rifle-musket at 300 yards, 40 inches. A 15-mile wind deflected the ball of the latter arm 6 inches at 200 yards, 3 feet at 500, and 12 feet at 1000.

Initial velocities as determined by the ballistic pendulum were:

Arm	Powder Charge	Bullet Weight	Mean Velocity (f/s)
Altered H.F. Rifle	60 grain	510 grain	914
Altered H.F. Rifle	70	740	883
New Rifle-Musket	60	510	963
Smooth-bore Musket	70	740	954
Old Musket	110	17/lb. (round)	1500
Old Rifle	70	32/lb. (round)	1750
Old Pistol	35	32/lb. (round)	947
Pistol-Carbine	40	468	603

The relative recoils of the various arms was indicated by calculation of the space over which the gun would recoil in one second if free. These figures were as follows: [18]

Arm	Powder Charge	Free Recoil in 1 Second (feet)
Altered H. F. Rifle	60	6.88
New Rifle-Musket	60	7.08
Altered Rifle-Musket	70	9.36
Old Musket (round ball)	110	8.83
Pistol-Carbine	40	8.06

Writing in 1856, Admiral Dahlgren said in reference to the theoretical results obtainable with smooth-bore muskets:

> Experience . . . proves that not even one tenth of the effect just indicated can be relied on; it must therefore be admitted that the excitement of the conflict, the noise, the smoke, the dust, the rash haste of some, the dullness of others, prevent the soldier from aiming and making the best use of his weapon. The perfect rifles cannot remedy this state of things. Our best disciplined troops never were able to control this kind of impulse and excitement. . . . In the combats of lines of skirmishers, the same results are noticed, and the soldier fires almost mechanically before him; it is only when he is sheltered that he can give full effect to the accuracy of his arm. . . . Hence it is probable that the rifled musket which can be loaded about as readily as the smooth-bore musket, furnishes all the facilities that are desirable for the ordinary purposes of an army.[19]

Dahlgren went on to say that "the performance of the Sharp' (*sic*) and Perry rifles and carbines are well known in the Navy. The facility with which they are handled on the practice ground, the power and accuracy of their fire, are admirable." Speaking of the revolver, he said, "The small (caliber 0.36) pointed shot of the common revolver has even been known to pierce vital parts with little permanent injury. In one [casualty] of recent occurrence, the shot entered at the back, passed through the lungs and was cut out of the breast; the wounded

man recovered in three weeks. Another received a shot through the liver and kidneys, but got well after an illness of some months." [20]

The "Walker" Colt revolver, adopted in 1847, was probably the most powerful hand gun ever used for military purposes. When the round ball was fired through its 9-inch barrel with the maximum 57-grain load of FFG powder, a muzzle velocity of about 1,300 feet per second was developed.[21] In a letter written October 5, 1847, to his brother, Captain Walker states, "They are as effective as a common rifle at one hundred yards and superior to a musket, even at two hundred." [22]

Like the carbines previously mentioned, these big revolvers had their faults, as indicated by the following letter:

Ordnance Depot
Vera Cruz, Mexico, May 8, 1848.

Col. G. Talcott
Ordnance Corps.

Sir: Five Companies of discharged Texan rangers have turned in their arms and accoutrements. Agreeably to the statement of Colonel Hays, these men received less than a year ago 280 Colt's patent pistols of which number 191 now revert to the U.States. The remainder chiefly bursted in their hands—tho a few were lost in skirmishing with the enemy.

Of the 191 turned in only 82 can be considered serviceable. All of the others have been more or less damaged by firing, and the wear and tear of some eight months use in the field. In some cases the cylinders are entirely destroyed—in others the barrels are irreparably injured where they join the cylinder—and again, having bursted at the muzzle, the barrels have been cut off to one half their original length.

As the pistols were turned in loaded, in attempting to discharge them the *Snaps* were found fully equal to the explosions—and in no instance were all the six charges, in any one cylinder, exploded—rarely ever four—frequently but two.

Colonel Hays states that for the first few days after his men received these arms they were continually bursting—but that, eventually, those which were left were fired with less certainty of such a result.

This being probably the first experiment of these pistols in actual service, I consider it worth while to commit the foregoing to paper.

I am respectfully,
Yr. Obt. St.
Jno. Williamson
Capt. Ordnance

Writing to the Secretary of War in November 1848, Mr. Colt attributed the revolver failures to defective material and to excessive cylinder length, which permitted overcharging. Both defects he proposed to remedy in his second contract.

Percussion revolvers had a bad habit of firing two or more shots at once upon occasion. That this was a recognized condition is shown by

a manufacturer's statement of 1854, concerning the Gibbs revolver: [23] "The slide is so constructed . . . to permit of the exit of all the balls at once, should they all go off, without danger to the person, the covering above the cylinder protecting the eyes and face, and the slide below protecting the hand from the effects of such an accident."[24] Concerning this characteristic, in 1846 an Ordnance Board had reported on the Colt Carbine: "If there is the slightest flaw in the ball . . . two or more charges will explode at once, which makes the use of them very dangerous. This accident has repeatedly happened at this post Carlisle Barracks. . . ."

During the Civil War, in a test of a Pettengill Army revolver at Springfield Armory, "the firing was accurate and the penetration good, the balls penetrating three white pine boards one inch thick and embedding themselves in a fourth, at a distance of fifty yards. The caliber of the pistol is .44. The charge twenty-four grains of powder and a conical ball weighing 218 grains. As many as sixty shots were fired." [25]

The various shoulder stocks issued for use with pistols and revolvers were not popular with the troops because there was considerable variation in the point of impact when fired with and without the stock. On the whole these combination arms were quite effective when used as carbines.

In 1842, during a Navy trial of the Jenks carbine, 14,813 successive shots were fired in a durability test—then the nipple split. The Merrill conversion of the Jenks carbine, as tested in 1858, gave a penetration of 7 inches in pine boards at 50 yards.

Most of the carbines used during the Civil War, and in fact for 15 years before, were sighted for ranges up to 300 yards. But their effective range was considered only about 150 yards. A Sharps carbine was fired during the tests of 1854. Of 25 shots fired at a target 8 feet square at 200 yards, one missed, and the rest formed a group with mean vertical deviation of 15.08 inches and mean horizontal deviation of 9.15 inches. A similar trial at 300 yards produced four misses, the mean vertical and horizontal deviations of the remaining shots being 23.96 and 7.94 inches, respectively. The report of the test indicated that the bullets were too large for the chamber diameter, resulting in inability to insert fresh cartridges after firing a few rounds. Also, the slide became very hard to operate when fouled. Paper left behind in the chamber was often on fire when the next cartridge was inserted. (The Sharps linen cartridge came later.)[26] As a result of Marine Corps tests in 1860, it was concluded, "Objections heretofore made

to this gun, of escapement of gas at the breech, waste of powder by the cut off, difficulty of inserting cartridges without bursting, paper left behind in the chamber, have all been obviated." [27] During the tests conducted in 1854 Sharps and Burnside carbines with standard loads penetrated, respectively, 7.27 and 6.15 inches of white pine at 30 yards.[28]

In 1859 the Burnside was tested at the Washington Navy Yard. At 500 yards 500 shots were fired without cleaning the carbine. There was no misfire. Of the total, 60 shots missed the target, including 30 to test the maximum rate of fire. It was reported that a buffalo was killed with one of these weapons at 800 yards.

The Maynard was tested by the Navy during the same year. Of 250 shots fired at 500 yards, all hit the target—80 percent within a 4-foot square. At 1,300 yards 14 of 43 shots struck and passed through a target 10 feet high and 30 feet wide (the boards were 1 inch thick). Twelve rounds were fired in 1 minute and 562 before cleaning. Two of the metallic cases were used to fire 100 rounds apiece, remaining in good condition.

Tests of the Greene oval-bore carbine produced one miss out of 36 rounds fired at 200, 300, 400, and 500 yards. This arm gave a penetration of 7 to 8 inches of pine boards at those ranges. The earlier conventional-bore Greene gave 16 inches penetration at 600 yards.[29]

Tests conducted by the Swiss in 1866 give a good idea of the performance of the Henry rifle. Though the model tested was the Winchester-Henry of 1866, the barrel length and action were the same, and the same cartridge was used as in the Civil War Henry.

A person inexperienced with the arm fired 21.9 aimed rounds per minute. The accuracy tests are shown in the following tabulation:

Paces	Elevation (degrees and minutes)	Shots	Hits	Radius (inches)
300	0–30	30	30	4
400	2–73	30	30	6
500	3–65	31	31	12.5
600	4–70	30	30	10
800	7–19	40	38	11.5
1000	10–32	31	31	24

In 1860 Major Colston reported to the Commissioners of the Virginia Armory on carbines. He stated that "the Smith . . . loads with facility while clean, but 60 rounds clog it up so badly that it cannot be loaded.[30] Burnside shoots admirably and does not foul . . . Maynard, extremely powerful . . . action best of those using special

cartridges . . . Merrill; solid action and gas-tight, no fouling after 100 shots." Major Colston objected to all carbines using special cartridges, in which the weapon could not be loaded in an emergency with loose powder and ball. The South had practically no facilities for fabricating metallic ammunition.

An official target report on the Model 1865 Spencer carbine shows that at 300 yards the average horizontal deviation was 1.084 feet, and at 500 yards 1.397 feet. At the latter range the bullet penetrated 5.91 inches of pine.[31]

There are not many detailed records of tests of Civil War machine guns. General Sickles reported favorably on some of the 50 Union "coffee-mill" guns that were purchased. He stated that they were accurate from 300 to 1,000 yards and proposed their use to cover the flanks of units. In 1862 the little-known machine gun called Rafael's repeating rifle was tested. It fired 60 to 90 shots per minute and was reported accurate to 2,000 yards.

During the Civil War so many foreign arms were used that even a bare listing of them would tend to become confusing.[32] A brief description of the characteristics of some of the more common or interesting types will serve to provide a basis for evaluating the rest.

The British model 1836 percussion musket, last of their smoothbores, was little better than the old flintlock Brown Bess. The effective range was 125 to 150 yards. A British colonel of infantry said "to fire at 300 or 400 yards is a misapplication of the musket, a loss of time, a waste of ammunition, and tends to make men unsteady in the ranks." [33] That model had a bore diameter of 0.760 inch and used a bullet of 0.701 inch, being 11 and 14 gauge, respectively. This excessive windage—one-third greater than that used in the United States—was bound to result in extremely inaccurate shooting.

In comparative tests of the British model 1842 rifled musket and the model 1851 rifle (Enfield),[34] 20 men fired 10 rounds each, five in file and five by volley, at a target 6 feet high by 20 feet broad. The results were as follows:

	1842 Musket		1851 Rifle (Minié-Type Bullet)	
Distance	No. of Hits	Percent	No. of Hits	Percent
100 yards	149	74.5	189	94.5
200 yards	85	42.5	160	80.0
300 yards	32	16.0	110	55.0
400 yards	9	4.5	105	52.5

Shots from the old musket that missed the target fell from 20 to 50 feet wide of it, whereas the Minié shot that missed fell within

2 or 3 feet.[35] Greener claims that during the Crimean War many Enfield rifles were expanded so much by the "Pritchett" ball used as to loosen all the bands. To remedy this an adjustable band was adopted.[36]

Some of the British "Brunswick" rifles were used in this country. These had a bore of 0.704 inch and used a spherical belted bullet to fit the 2-groove rifling. Angles of elevation were determined by tests conducted in 1852, as follows:

Range	Angle of Elevation (degrees and minutes)
100 yards	0–08
200 yards	0–34
300 yards	0–54
400 yards	1–26
500 yards	?

At 500 yards the shooting was too wild to allow determination of a consistent angle. This rifle was shown to be very inferior in range. Loading was so difficult that a man's hand became too unsteady for accurate shooting.[37]

The Whitworth hexagonal-bore rifle was used by the Confederates for long-range sharpshooting. In 1857 this rifle was tested at Hythe (British equivalent of Camp Perry). The power and efficiency of the Whitworth over the Enfield was estimated as 20 to 1. At 1,800 yards (over a mile) it struck the target with force, while the Enfield made no hits at 1,400 yards. At 1,100 yards the Whitworth was on a par with the Enfield at 500. With the same charge (70 grains) it shot a bullet through 33 half-inch elm planks compared with 12 for the Enfield.[38] A tabulation of these tests follows:[39]

Arm	Yards	Elevation (degrees and minutes)	Mean Radius (feet)
Whitworth	500	1–15	0.37
Enfield	500	1–32	2.24
Whitworth	800	2–20	1.00
Enfield	800	2–45	4.11
Whitworth	1100	3–45	2.41
Enfield	1100	4–12	8.04
Whitworth	1400	5–00	4.62
Enfield	1400	6–20 to 7–00	no hits
Whitworth	1800	6–40	11.62

The comparative accuracies of the French musket and *a tige* rifle were shown by tests conducted at Metz. In these, 15 marksmen fired a total of 60 rounds at each range. Results were as follows:[40]

Range (yards)	Target Size (feet and inches)	Musket		A Tige Rifle	
		No. Hits	Percent	No. Hits	Percent
164...........	6–6 by 1–10.5	18	30	37	61.7
218...........	6–6 by 4–8.7	21	35	45	75
437...........	6–6 by 6–6	3	5	31	51.7
656...........	6–6 by 13–0	..	..	25	41.7
874...........	6.6 by 19–0	..	..	14	23.3

The Minié ball was, in turn, superior to the tige.

Trials at Washington Arsenal in 1856 gave an idea of the performance of an Austrian rifle. The weapon tested was of caliber 0.55, with four grooves of uniform twist. It fired a solid expanding ball of 450 grains, with a charge of 62 grains. The cartridge paper was saturated with grease at the ball end and was loaded with the ball, serving as a patch. Of 23 shots fired at 300 yards range, six missed the target, and the rest formed a group with mean vertical and horizontal deviations of 15.12 and 12.1 inches, respectively.

The Belgian calibers 0.69 and 0.71 rifled-muskets were about equal in performance to corresponding United States weapons. In general the Austrian arms were the poorest imported, from workmanship more than from design.

In summary, the smooth-bore musket and the rifled carbine, though capable of inflicting a dangerous wound at longer ranges, were ineffectual for aimed fire at much over 150 yards. The maximum practical range of the round-ball rifle was about 300 yards. The rifled-muskets and rifles using the conical ball, however, were sighted for and quite capable of serious target shooting at 600 to 1,000 yards. Then as now, the extreme practical range of the pistol was 50 yards.

The rifles, muskets, carbines, and revolvers used by our troops can hardly be considered apart from the ammunition they used. For best results ammunition and weapon have to be developed concurrently. One is useless without the other. The arms, being much more durable, have been passed down to us in more or less good condition, with physical characteristics quite evident on inspection. Ammunition, however, has withstood the ravages of time less successfully. It was expendable. Many types can be envisioned only from the printed descriptions of their manufacture.

NOTES

(See Bibliography for full literature citations)

1. Panot, L., Aide memoire. Hereafter cited as Panot.
2. Wheeler, H. F. B., and Broadley, A. M., Napoleon and the invasion of England.

3. The term "point blank" range came into use through an erroneous theory of exterior ballistics. It was thought that the path of a bullet as it left the muzzle of a gun was perfectly straight for a considerable distance and that as the bullet lost velocity gravity started to act and caused it to fall to earth along a parabolic curve. The point-blank range of a piece was the distance the ball was believed to travel before leaving a straight-line path. The French bullseye being white, *point blanc* meant "aim at the center."

4. Deane.

5. Piobert.

6 to 11, *Ibid.*

12. Duane, William, Handbook for riflemen.

13. Senate Doc. 503, 26th Congress, 1st Session, 1839-1840.

14. Rep. Exp. Gunpowder.

15. *Ibid.*

16. Small arms, 1856.

17 and 18. *Ibid.*

19. Dahlgren.

20. *Ibid.*

21. Figure supplied by Sam Feldman, Ballistics Eng. Ordnance Dept.

22. Haven, C. T., and Belden, F. A., A history of the Colt revolver.

23. An English revolver used during the Civil War.

24. Senate Doc. 72, 37th Congress, 2d Session, Report of Commission on ordnance.

25. Annual of Scientific Discovery, 1864.

26. Small arms, 1856.

27. Fuller, Claud E., The breechloader in the Service.

28. Small arms, 1856.

29. Satterlee.

30. This model was the one that used the rubber cartridge.

31. Ord. Memo. No. 5. Proceedings of Ordnance Board convened Sept. 12, 1863, Washington, 1864.

32. For details of many of these see Mordecai, Military commission to Europe in 1855 and 1856.

33. Blanch.

34. The Model 1851 used the Pritchett bullet, made on the Minié principle.

35. Douglas, Howard, Treatise on naval gunnery.

36. Greener, 1858.

37. Gordon, A., Report of experiments with small arms, Enfield, 1852; London, 1853.

38. Busk.

39. Greener, 1858.

40. Panot.

Chapter V

AMMUNITION

The ammunition made by the millions of rounds for use in our muzzle-loading service arms has by now been fired or broken up, with but relatively few exceptions. Here and there specimens are to be seen in museums, in collections, and even still in storage in Government arsenals.[1] Most of them are now unidentified, and surprisingly little knowledge of these once-important cartridges has survived. However, most of the major varieties have quite distinctive characteristics, and a combination of description and photographs will help to identify them.

During the Revolutionary War the only small arms that approached standardization in the American forces were those of the French and British armies. These were of various models, dating back in many cases to the French and Indian Wars. The cartridges used were similar to French and British types, with similar balls and charges. Identified specimens are rare.

The "Brown Bess" used a ball supposedly standarized at 14 per pound, or caliber 0.688. From examination of 70 bullets found on British campsites [2] it appears that they varied from 0.687 to 0.700 inch in diameter, with an average of 0.694. The British charge was 6 drams (or 163 grains). The cartridge tube was tied with string ahead of the bullet and filled with powder, and the end twisted tightly. No contemporary specimen could be found for illustration of the ball cartridge. However, a buckshot round (pl. 23i) appears to answer the general description of the British cartridge.

The French load for the "Charleville" musket contained 189 grains of powder and a ball of size 19-to-the-pound. Plate 23a shows a ball cartridge made during the Revolutionary War for use in the French musket. It is made of paper from a public document—the words "of the Confederation" and "Domestick Affairs" can be read on the sides. This cartridge illustrates a general type that remained in use until the middle 1830's. In this the folded "pigtail" at the rear of the cartridge was either twisted or twisted and then doubled back as was the standard practice at a later date. The bullet end was pasted shut instead of tied. The French cartridge may be distinguished from

the British by its smaller ball. The French-style wrapper had a straight pasted seam; that of the British was usually cut on a diagonal.

In addition to the standard foreign arms, the Continental forces used many different weapons. The Pennsylvania Committee of Safety reported in May 1777 that the following gauges of bullets were then in use: 13, 15, 17, 19, 21, 24, and 30.[3] This represents a range of caliber from 0.54 to 0.73. On October 6, 1777, GHQ at Perkiomy ordered that "Buckshot are to be put into all cartridges which shall hereafter be made." [4] From this it appears that the "buck-and-ball" combination became popular with our Army at an early date. Writing in a tactics manual, printed in 1814, Benjamin Moore said that the standard musket cartridge of the period 1812-13 was the buck-and-ball cartridge. Fifty years later this load was still considered of great value for guard duty, Indian fighting, and most any operation in brushy country.

Our first official rifle load, that established for the Model 1804 "Harpers Ferry" rifle, remained the same through the flintlock and into the percussion period. In 1810 Duane [5] said, "The proof bullet of the United States musket made at Harpers Ferry in Virginia, the barrel of which is 3 feet 8¾ inches, is one fifteenth of a pound; the service bullet one nineteenth. The Rifle of Harpers Ferry, the barrel of which is 2 feet 10 inches; the proof ball is one twenty eighth of a pound; the service ball one thirty second part of a pound." The cartridge for the "common rifle" (pl. 27d) contained a patched ball (pl. 27e). This was the characteristic that distinguished the ammunition for the common rifle from that for the Hall's rifle, which used a bare ball. (See pl. 27g.) The patch, of bladder or similar membrane, was firmly tied to the ball.

In a letter written in 1813 the Commissary-General of Ordnance [6] said, "Proof charge for the musket is equal to the ball weight (1/18th of a pound). The service charge of powder about one forty-fifth of a pound (157 grains, plus priming). Ratio to proof charge—2½ to 1."

The years following the Revolution brought successive improvements in gunpowder and better understanding of ballistics, which together resulted in a series of reductions in powder charge. The musket cartridge used in the War of 1812 (pl. 23b) contained about 160 grains of powder and a ball of size 18-to-the-pound. This combination produced a velocity of about 1,440 feet per second but gave excessive recoil. The Army found that after the charge was increased to a certain point further increase caused a reduction in velocity, though the recoil continued to grow greater. The French charge of

that period (with the same size ball) was 146.5 grains plus priming, or about 158 grains. As in the Revolutionary period, both buck-and-ball and buckshot loads were used in addition to the regular ball. (See pl. 23g, i.) Relatively few standard rifles were in service and they were usually loaded with loose ammunition, that is, with patched ball and powder from a flask.

I was unable to find specific references to the loads employed in the caliber 0.69 contract pistols, but I felt a little better about it on seeing a letter written March 31, 1827, by Ordnance Inspector J. Weatherhead to Colonel Bomford, Chief of Ordnance. Weatherhead on being assigned to inspect some North's pistols said that he was familiar with the charges used in the musket, rifle, and pistol of rifle bore, but asked what charge to use where the "pistols differed from the rifle bore, viz ½ an ounce." At a considerably later date these pistols fired a 65-grain charge (pl. 31a, b). The original load was probably at least 73 grains.[7] In 1810[8] the British charge for a similar pistol was 82 grains.

The first published tabulation of United States Army cartridges, with powder charges and bullet weights, appeared in the Ordnance Regulations of 1834, as follows:

Established Charges for Small Arms

Nature of Small Arms	Charge of Powder in Grains, Priming Included	Service Charges: No. of Charges in One Pound	Service Charges: No. of Balls in One Pound	No. of Buck Shot, 180 to the Lb., in a Charge	Salute or Exercise—Charges of Powder in Grains, Priming Included
Musket	144	48.61	18	15	120
Common Rifle	100	70	32	..	73
Hall's Rifle	100	70	32	..	73
Hall's Carbine (percussion)	85	82.35	32	..	62
Pistol	51	137.25	32	..	51

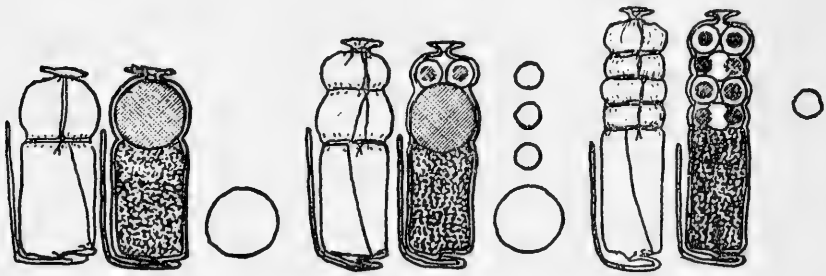
These same regulations, in illustrating proper rendering of returns of Ordnance stores, listed:

100,000 musket ball cartridges at $9.47 per M.
10 barrels of powder at 20 cents per pound.
2832 percussion primers for small arms, at 1 cent each.

These primers were for use with Hall's carbine, introduced in 1834; the first arm with percussion ignition to be adopted in a military service.

About 1835, when new arms models were being considered, there were also some changes in cartridge specifications. The most obvious

of these was a change in folding the paper pigtail. From that date to the end of the paper cartridge period, the folded end of the cartridge was turned forward alongside the powder charge. The accompanying drawing (fig. 16) shows the construction of the principal types of



a. BALL b. BUCK AND BALL c. BUCKSHOT

FIG. 16.—Ammunition for caliber 0.69 musket.

ammunition made in the manner just described. Figure 16a represents the ball cartridge, tied above the ball and choked with the same string between ball and powder. Figure 16b is the buck-and-ball round, containing three buckshot above the round ball with an additional half-hitch between them. Figure 16c shows the buckshot cartridge, containing four layers of three buckshot each. Each layer is separated by a half-hitch.

Charges in use in 1837 were listed in an official report of tests at West Point, N. Y.[9]

1837 CARTRIDGES

Arm	Caliber	Ball: Diameter	Ball: Weight (grains)	Powder Charge	Weight of Paper	Total Weight
Musket, Flint..	0.69	0.64	397.5	144 [1]	11.5	553
Rifle, 1817	0.54	0.525	219	100 [1]	10.0	332 [2]
Hall's Rifle ...	0.52	0.525	219	78 [1]	8.4	305.2 [3]
Hall's Musket.	0.64	0.64	397.5	110 [1]	10.2	517.7
Hall's Musket, Percussion ..	0.64	0.64	397.5	86 [4]	...	....
Buck and Ball.	0.64	0.64	397.5 & 3 buck	144	...	....

1 Includes 8-10 grains priming charge.
2 Includes 3.4-grain patch.
3 Same load as for Cadet musket.
4 The 110-grain charge also used.

The above table indicates that the Army did use some of the Model 1834 Hall's carbines with receivers from the flintlock Hall's rifles substituted for the percussion-type receivers standard with the car-

bines. For years collectors of firearms have doubted the legitimacy of percussion Hall carbines found with flintlock receivers installed.

When new powder was purchased in 1837 and 1838, it was found to be greatly superior to the old supply. With stronger powder, charges could be reduced materially. The first record of these new specifications is found in a manuscript for the first Ordnance Manual, prepared in 1839.[10]

Service Charges for small Arms [1839]

Nature of Small Arm	Number of Balls in One Pound	Charge of Powder in Grains, Troy Weight	Number of Charges in One Pound (Avoirdupois)	Remarks
Musket	18	130	54	Priming included
Musketoon	18	85	80	Priming included
Hall's Carbine— Musket cal.	18	75	93	Percussion lock
Hall's Carbine— Rifle cal.	32	75	93	Percussion lock
Hall's Rifle	32	100	70	Priming included
Common Rifle	32	100	70	Priming included
Pistol	32	50	140	Priming included

For blank cartridges the above charges of powder shall be reduced one-tenth.

In 1841 the Ordnance Manual, as printed, contained an expanded table, as follows:

	Diameter Ball	No./Lb.	Powder Grains [2]	[Plate No.]
Musket (Single Ball, Buck & Ball)..	0.64	18	130 M	24a, b
(Blank)	...	..	117 M	24d
(12 Buck shot)[1]............	...	..	130 M	24c
Musketoon (Ball)	0.64	18	85 M	24e
(Blank)	...	..	77 M	24h
Hall's Carbine (Ball)	0.64	18	75 R	25d
(Blank)	...	..	68 R	...
(Ball)	0.525	32	75 R	...
(Blank)	...	..	68 R	...
Hall's Rifle (Ball)	0.525	32	100 R	27g
(Blank)	...	..	90 R	...
Rifle (Ball)	0.525	32	100 R	27d
(Blank)	...	..	90 R	27e
Pistol (Ball)	0.525	32	50 R	31f
(Blank)	...	..	45 R	31g

[1] Buckshot 0.3 diameter, 170/lb.
[2] Includes 6 to 12 grains priming except for Hall's Carbine (Perc.)
NOTE: The designations "M" and "R" after the powder charges indicate musket and rifle powder respectively.

During the elaborate tests of gunpowder made at Washington Arsenal in 1843 and 1844, the service loads then in effect were listed.

Note that a percussion rifle had been adopted in 1841, and a percussion musket in 1842.

STANDARD CARTRIDGES IN 1842

Arm	Caliber	Ball		Powder Charge	Weight of Paper	Total Weight
		Diameter	Weight			
Musket	0.69	0.64	397.5	130 gr.	10.8 gr.	538.3 gr.
Cadet's Musket	0.57	0.525	219	78	8.4	305.2
Musket, Percussion	0.69	0.64	397.5	120	10.8	528.3
Rifle, Percussion	0.54	0.525	219[1]	100	10.0	332.4
Hall's Rifle	0.52	0.525	219	(Same as Cadet)		
Hall's Carbine, Percussion	0.52	0.525	219	100	10.0	329
Jenks' Carbine	0.52	0.525	219	70	8.0	297
Pistol, Percussion	0.54	0.525	219	35	5.5	259.5

[1] Weight of patch 3.4 grains.

Though the official tables of 1834 and 1839 showed the 100-grain charge for the Hall rifle, lists of cartridges actually being used in 1837 and 1842 showed the lighter cadet-musket load as that fired in the Hall arm. It was said that the gas leakage at the breech of the Hall was terrific when fired with the regulation load.

With an accurate means for measuring velocities, then for the first time available in the United States, it was possible to analyze and compare small-arms ammunition. Captain Mordecai[11] made an extensive report, excerpts from which follow:

Of the proper charge for the percussion musket . . .

The cartridge for the flint musket contains 130 grains weight of powder, from which, deducting about 10 grs. for priming, we have 120 grains for the charge which is put into the musket. This charge has always been considered ample in service, and when composed of the best powder, it is quite as much as can be used with comfort to the soldier, in firing the present ball of 18-to-the-pound.

The sufficiency of this charge may also be deduced, by analogy, from that of the French flint lock musket, which is the model of ours. When the charge was established at the present standard of 146.5 grs. it was found, by numerous experiments, that the effect of this charge, with the ball of 18-to-the-pound, was equal to that of the former charge of 189 grs., with the old powder; and the ball of 19-to-the-pound; and this latter change, having been used in all the wars of the revolution, was thought to have been proved sufficient, by long experience. Now, by the experiments with powders from a large number of the French powder works, which led to the adoption of the present standard of proof by means of the musket pendulum, it as found that the mean velocity of the ball, with a charge of 154 gr. (10 grammes), was 1477 feet, which was therefore adopted as the minimum velocity for the proof of musket powder. The proportional velocity with a charge of 146.5 grs., would be 1440 feet, considerably below that of 1500 ft. which we have obtained for the same ball, with the charge of 120 grs., of the powder A.4. It may be remarked, here, that some of the French musket powder, although made in the pounding mill, is of not very in-

ferior force to this powder A.4, as will be seen by the experiments with the sample of powder made at Bouchet, which gives a velocity of 1478 feet with a charge of 120 grs., and would therefore give about 1630 ft. with the charge of 146.5 grs. But we see that, by reducing the size of grain of our musket powder and making it conform more nearly to the English powder, we may obtain, with a charge of 120 grs., a force nearly equal to that of this Bouchet powder, with a charge of 146.5 grs. We may, therefore, regard this charge of 120 grs. as sufficient for the musket, with a ball of 18-to-the-pound, having 0.05 in. windage.

But we find, from the table of experiments, that by reducing the windage of the ball to 0.04 in. and increasing its weight to 1/17th of a pound, we may obtain, with the percussion musket, as great a velocity with this heavier ball with a charge of 110 grs. as for the smaller and lighter ball with 120 grs., and this without any increase in the force of recoil. Having satisfied myself, by the trials mentioned in the Journal, that this increase in the diameter of the ball will not impede the service of the arm if the balls are smooth, I propose that the changes above indicated, in the kind of powder, the charge, and the size of the ball, should be adopted in service, and that in order to ensure the uniformity and smoothness of the balls, they should be made by compression, as is now practiced in the British service, and in some others.

In this manner, we may obtain, with the charge of 110 grs. in the percussion musket, an initial velocity of about 1500 ft., which is greater than requisite for a musket ball, and leaves sufficient room to allow for deterioration of the powder, or for accidental loss of a small portion in loading, etc. as well as for variations of windage, consequent on the differences permitted in the bores of muskets.

As a further evidence of the sufficiency of this charge, we may compare the experiments on the range of the musket with those made in France, with the same ball of 17 to 1 lb. and the old charge of 189 grs., as stated in the *Aide Memoire d'Artillerie:*

French Powder Charge 189 grs.		Powder X Charge 110 grs.	
Abscissa Yds.	*Ordinate* In.	*Abscissa* Yds.	*Ordinate* In.
76.6	6.38	80	7.7
120.3	17	120	23
153	28.83	150	32

According to the same authority, an elevation of 33 min. is required for a range of 219 yds., with the charge of 146.5 grs. and the ball of 1/18th lb.; and I find nearly the same result with the ball of 1/17th lb. and the charge of 110 grs., viz.: that an elevation of about 36 min. is required for a range of 200 yards. The range of 500 yds. requires, with this charge, an elevation of less than $3\frac{1}{2}°$, and at that distance the ball retains sufficient force to pass through a pine board 1 in. thick, showing that it would inflict a serious wound at a still greater distance.

I may add, also, that the charge for the British percussion musket is reduced to $4\frac{1}{2}$ drachms, or 123 grs., whilst the ball is $14\frac{1}{2}$-to-the-pound, or 480 grs. This charge is therefore smaller, in proportion to the weight of the ball, than that here proposed, in the ratio of 3.73 to 3.93.

By the new edition of the *Aide Memoire d'Artillerie,* I find that a change similar to that which I propose has been adopted in establishing the charge

of powder and ball for the new percussion musket in the French service. The windage of the ball has been reduced to 0.04 in. and although the bore of the musket is enlarged, so as to receive a ball of 1/15th pound, or 467 grs., the charge is reduced to 123.5 grs. This charge bears almost exactly the same proportion to the weight of the ball as that which I propose; but the use of pounding-mill powder is continued for the military service in France, notwithstanding its inferior force, in most cases.

. . .

The force of the charge of 35 grs. in the pistol, is greater than necessary for that arm, and the experiments made on 19th Dec'r, 1844, show, that with 30 grs. of good powder, the pistol ball is propelled with sufficient velocity to inflict a severe wound even at more than 80 yards; but as this charge can be fired without inconvenience to the hand, I should not propose less than 30 grs. as the charge for the pistol.

Numerous experiments on ranges, made at Washington Arsenal, have shown, that with good powder, the charge of 70 grs. is sufficient for the percussion rifle, even at the distance of 300 to 350 yards, and we might draw the same inference from the velocity which this charge communicates to the ball; but as the charge of 75 grains can be fired with perfect ease, and without *stripping* the ball, it would be perhaps safer to adopt that charge, in order to provide for accidental loss, deterioration of powder, etc. This charge is considerably greater, in proportion to the weight of the ball, than those lately adopted for the English and French service rifles; but it is properly so, because the weight of our rifle ball, being of less than half the weight of either of those, will be more effected by the resistance of the air, and should, therefore, have a greater initial velocity.

In order that Hall's rifle may be effective at long distances, its charge should hardly be less than 100 grs., and the chamber of the rifle ought to be enlarged, to admit that charge, if the arms should be again put in service.

Conclusions . . .

For musket powder, I would recommend a reduction of the size of grain, to be regulated by the present standard gauges as follows:

All the grains should pass through No. 4
About one-half through No. 5
Nearly one-fourth through No. 6

This would give about 2000 or 2500 grains of powder in 10 grs. Troy.

For rifle powder, a small reduction may also be made in the size of the grain, by requiring that all the grains pass through No. 6, the other gauges being used according to the present regulation. There would then be about 12,000 or 15,000 grains of powder in 10 grs. Troy.

For small arms, the following charges are proposed:

For the percussion musket, with the proposed musket powder, 110 grs.
For the percussion rifle, 75 grs.
For the percussion pistol, 30 grs. of rifle powder.

For small arms also, especially for the musket, the variation now allowed in the diameter of the bore is, I believe, unnecessarily great. But for these arms, a much more important change is that of reducing the windage, by increasing the diameter of the ball, and to effect this object, with certainty and uniformity,

I propose that balls for small arms shall be made by compression, instead of being cast.

The 1841 rifle had a reputation for extreme recoil. This can be appreciated on noting that the percussion rifle cartridge of 1842 retained the original flintlock charge of 100 grains, thus adding the priming charge to the main load. Instead of 90 grains of mediocre powder, the percussion rifle at first used 100 grains of much improved powder. Probably Mordecai's recommended charge of 75 grains gave a performance at least equal to that obtained with the original flintlock ammunition.

The Hall's rifle charge, then 78 grains, was no doubt equivalent to that of the older 100-grain cartridge, which included 10 grains for priming. When Mordecai suggested enlarging the Hall's rifle chamber so as to hold 100 grains, he was talking about a rifle altered to percussion. The original flintlock Hall chamber would not take the entire charge of 100 grains.

Captain Mordecai's recommendations were adopted, for the most part, and the resulting new loads for service arms were published in 1849, in the second edition of the Ordnance Manual:

CARTRIDGES FOR SMALL ARMS [1849]

	Percussion		Charges of Powder				
Kind	Balls Diameter	No. in 1 Lb.	Weight	No. in 1 Lb.	Ratio to Weight of Ball	Blank Cartridges	Remarks
Musket	0.65	17	110	64	1–4th	75	Musket Powder
Musketoon	0.65	17	75	93	1–5th	75	" "
Hall's Carbine ..	0.525	32	75	93	1–3rd	60	Rifle Powder
Rifle	0.525	32	30	93	1–3rd	60	" "
Pistol	0.525	32	30	233	1–7th	30	" "

Buckshot are 0.31 in. in diameter; weight about 150 or 155 to 1 Lb. Cartridges are made with *single* ball, 1 ball and 3 buckshot, or sometimes with *12 buckshot,* and they are designated accordingly.

Most of the cartridges described in the 1849 Manual are illustrated as indicated. Plate 25 shows the musket ball, buck-and-ball, and buckshot cartridges in a, b, and c. The corresponding musketoon loads are shown in f, g, and h, and those for the Hall carbine in d and e. Plate 27, h and i, are the rifle ball and blank cartridges. Pistol ball and blank specimens are shown on plate 31, j and k. Item i is the 35-grain pistol ball cartridge mentioned by Mordecai as the standard in 1842, when the percussion pistol was first introduced.

In 1842 the Army had started to experiment with elongated balls. Some caliber 0.69 muskets were rifled and tried with variously shaped projectiles. Conical-ball loads were also made up for the caliber

0.54 rifle. After the tests of 1853-55 [12] the Army reduced the standard musket caliber to 0.58 inch and adopted the Maynard tape-primer ignition system.

The first of the expanding bullets used by our Army employed the Minié principle, incorporating a tapered plug in the base. These plugs were made of wood or of a lead alloy. It was soon discovered that with a cavity of suitable size and shape the wedge was not necessary. Most military services of the Civil War period used the same general principles, either direct—gases acting in the bullet cavity—or indirect—upsetting the ball. The United States caliber 0.58 bullet was essentially the French *tige* bullet with a base cavity added. At first this cavity was made in the shape of a truncated cone, but this was found too weak in the rifle-musket. It was retained for use with reduced charges, as in the pistol-carbine, but for full loads a cone-shaped cavity was used. For a drawing of these bullets see Chapter VI, figure 23. No patch of any kind was used in loading them. In nearly all other service bullets of the period a greased patch of cloth or paper covered the bullet when placed in the bore. Our bullets were lubricated with a mixture of four parts beeswax to one part tallow, applied by dipping.[13]

The report of the Chief of Ordnance for the year ended June 30, 1844, showed that "150,000 tin foil musket cartridges and 50,000 each for rifle and carbine" were purchased. They were tested the following year. Though it appears from correspondence that these cartridges were finally delivered, I do not know of an existing specimen.

Professor Shönbein, who discovered guncotton, published his first observations in 1846, patenting the product during that year in the United States. That same year Captain Mordecai tried guncotton as a propellant for small arms, in tests conducted at the Washington Arsenal. He used the standard musket ball (17-to-the-pound) wrapped in cartridge paper with 30 to 60 grains of guncotton. The charge occupied four times the space of the same weight of gunpowder. The 60-grain charges developed a velocity of 1,670 feet per second. The average obtained in firing 48 standard rounds was 1,600. Thus half the weight of propellant produced at least equal velocity with negligible fouling. However, a double charge burst the barrel at the breech, the barrel having been given previously the standard barrel proof: first charge 390 grains with a 15-to-the-pound ball and two wads; second charge 318 grains with the same size ball and no wads. Based on these tests, guncotton was considered unsuited for use in small arms.

In Europe an Austrian baron, General Von Lenk, made numerous

experiments with guncotton but with the main emphasis on its use as an artillery propellant. It was necessary to control the combustion space accurately and to retard the rate of burning. To get the first result in small arms ammunition, Von Lenk attached a small stick to the base of the bullet so as to assure the correct positioning of the charge between breech and bullet. He used a finely braided material in order to retard the rate of burning.[14] During the Civil War the United States Army purchased 1,000 of these cartridges in caliber 0.58 for trial. They were listed in Ordnance Memorandum No. 1.

In 1864 Major Laidley[15] mentioned the Von Lenk ammunition. He said that the 1,000 rounds ordered were for use in the Springfield musket and were to be loaded by dropping into the barrel by their own weight. He stated that the 22-grain charge of guncotton with the 448-grain ball on a stick gave the same velocity as our 520-grain ball with 60 grains of gunpowder. One of the Von Lenk cartridges is shown on plate 37a.

During the course of the Civil War certain combustible envelope cartridges, made with a covering of some nitrated material, were sometimes also termed "guncotton" cartridges. The type to which the name was properly applied was the Von Lenk, the term "combustible" being more appropriate for those that used such material simply as a covering for the conventional gunpowder. The Barlow cartridge (pl. 37b) consisted of a bullet attached to a tightly rolled coil of nitrated paper. It, too, was strictly speaking a guncotton cartridge (or nitrocellulose) as contrasted to gunpowder. Though the Barlow cartridge is listed in the Frankford collection along with other United States military specimens, no specific reference has been found to indicate service use. It may have been for trial only. The paper used is a dark purple, almost black.

With the new arms adopted in 1855 came a new type of cartridge. In this the powder was contained in a separate cylindrical case made of heavy rocket paper (about like light cardboard). This case was rolled in a piece of cartridge paper and filled with powder; then the whole thing was placed on another piece of paper with a bullet and rolled again. This stiffer construction resulted in much less damage in the field after issue to the troops. At about the start of the Civil War—the exact date is not known—the old system was reinstated, perhaps because it was simpler. Cartridge specifications in 1856 were as follows:

Arm	Caliber	Ball Diameter	Ball Weight	Powder Charge
Altered Musket	0.69	0.685	730 gr.	70 gr.
Rifle & Rifle-musket	0.58	0.5775	500	60
Cadet Musket	0.58	0.5775	450	40
Pistol-carbine	0.58	0.5775	450	40

In the course of service trials the Army found that the light 40-grain charge for the cadet musket did not upset the ball sufficiently, and so the charge for that arm was increased to 50 grains. That for the pistol-carbine was left at 40, which was considered the maximum that could be fired without discomfort to the soldier.

Apparently not many caliber 0.58 cartridges were made following the specifications of 1856, or if made they were all expended, as no specimens could be found for illustration. However, the same type of construction was used in cartridges for the caliber 0.69 rifled musket and musketoon during the Civil War, probably because the heavy bullet required a more substantial wrapping. Plates 26a, b, and 25i show the rifled-musket cartridges in ball, buckshot, and blank loads. Plate 26c shows the musketoon ball cartridge with the first-type ball, employing a wooden plug. Item e shows the later ball without a base plug. The buckshot cartridge for the musketoon is shown in plate 25j.

After the United States Army contracted to manufacture breech-loading arms on the Morse principle, a few rifles and muskets were converted to that system at the Springfield Armory. Only a few specimens were made in calibers 0.54 and 0.58, but the caliber 0.69 muskets were produced in quantity sufficient for trials. While they were being made a contract was given to the Muzzy Rifle and Gun Manufacturing Co., Worcester, Mass., for 10,000 caliber 0.69 Morse cartridges. A sample gun was sent them for use in testing cartridges. The Morse cartridge made by Muzzy evidently had a cast-brass case about $1\frac{1}{2}$ inches long by 0.72 of an inch in diameter. Some of them were loaded with buckshot. I have been unable to locate one of these specimens, but judged from the construction of the caliber 0.69 Morse musket the cartridge must have had a very thin wall for a casting, as a part of the bolt face projected into the chamber, behind the extractor hook, and left little clearance. A letter referring to the Morse ammunition follows:

U. S. Armory,
Springfield, April 22, 1859

Col. H. K. Craig,
U.S.A. Ordnance Dept.,
Washington, D. C.

Sir: We forward by express this day, two boxes to your address, containing two (2) Muskets, Model 1822, altered in conformity to the latest orders received for the alteration to Morse patent. Also 200 cartridges charged with Powder and Buck shot, to wit: 70 Grains of powder & 12 Buck Shot. The tools for casting the Cartridge cases, and the quantity of Powder & Shot having been prepared according to the directions of Mr. Morse. We hope to forward two

altered rifles, each .54 and .58 by the 15th proximo. I deem it to be proper for me to state, that in consequence of the change of model, we shall be compelled to fabricate new tools, to considerable extent—and we think with the best economy that we can use it will, if the present method of alteration is adhered to, cost about $1200 to prepare the models & tools—and after that we shall not be able to make the alteration for 2000 only—at less cost than $5.00 a musket.

I remain,
with the highest respect
Your Obt. Servt.
James S. Whitney
Supt.

One sample caliber 0.58 Morse musket was made and issued to Harpers Ferry Armory. Three were made in caliber 0.54, but they were never issued from Springfield Armory, and in 1877 they were transferred from store to the Armory Museum. Frankford Arsenal made some Morse ammunition in 1860, in calibers 0.54, 0.58, and perhaps 0.69. These were the relatively familiar Morse type, tinned, and with flanged heads and rubber bases. What they were used for is a mystery; perhaps they were just to familiarize the Arsenal personnel with the manufacture of metallic cartridges, the Morse being one of the first to contain its own primer. The caliber 0.58 ammunition was said to have been made for the Navy, but the only Morse gun recorded in that size was the one sent to Harpers Ferry as a model. It was expected that Morse rifles would be manufactured there, but the war changed the plans. (See pl. 39a, b, for Morse cartridges as made at Frankford.)

In the United States beginning about 1845 considerable attention was given to the development of breech-loading small arms. The main objective was to produce a suitable arm for mounted troops, one that would be safe and easier to manipulate in the saddle than existing carbines or musketoons, which were loaded with separate or swivel ramrods. The type of cartridge used with the older weapons required too many motions for loading and firing. Breech-loading systems had been known and experimented with for years, but it was not until the perfection of the metallic cartridge that they really became effective. The expansion of this type of cartridge on firing, to form a perfect gas seal at the breech, was the solution to the major problem of the breechloader.

In the first efforts to effect this solution paper-case ammunition and linen-case ammunition were tried. Though some of the arms using this sort of cartridge were very ingenious and gave good results, they were not perfect. The best known and most popular among these was the well-made Sharps, first used in the early 1850's with

paper cartridges, which in its final form was generally acknowledged the best of the weapons using linen cartridges. The gas check in this arm was an expanding metal ring in the breech block, which worked effectively. The linen cartridge used in the Sharps rifles and carbines is shown on plate 36b. The original Army-type Sharps cartridge was made of paper, like that for the musket except that the paper was tied to the base of the bullet. (See pl. 30h, j, k.) The Confederate Sharps used a similar load (pl. 32f). During the Civil War paper Sharps cartridges were made that had a thin piece of tissue paper pasted over the end of a fairly heavy paper tube (pl. 30i). The flame from the percussion cap perforated the thin paper readily. When paper ammunition with a pigtail on the end was used, the sharp edge of the rising breech block cut this off, exposing the powder.

A number of other linen cartridges for carbines were used in the Army: Starr, Perry, Gibbs, and Union or Cosmopolitan. The Navy Jenks carbine had a linen cartridge, though loaded from a flask when originally introduced. The Starr and Union types are shown on plate 36a, c; the others are unknown except for generalities. The Sharps, Starr, and Union cartridges can be distinguished easily by their characteristic bullets. That for the Sharps had a tying groove around its base. The Starr bullet had a ridge at the base. The Union bullet was smooth, with a ring of short longitudinal serrations around its base at the point where it entered the case.

A cartridge believed to be for the Jenks carbine is shown on plate 36d. It fits the bore and chamber as to diameter, but is much reduced as to load. As the arm was originally made for flask loading, the small top opening in the breech would not permit entrance of a fixed cartridge longer than this one. Perhaps this linen type was used in the Jenks arms altered by the Merrill system, in which the plunger filled more of the chamber than in the original system. The Merrill patent, issued July 20, 1858, and reissued in 1861 included: "Claim—Converting what is known as the 'Jenks-gun' from a loose powder and ball loader to a cartridge loader, by closing up the opening through which that gun was loaded, cutting away and opening out in rear of the barrel so as to load at the rear end of the bore, and allowing the lever, toggle and piston to come far enough back to admit a cartridge to be dropped in behind the bore, and thence run up into the chamber, as set forth." A Navy report of tests of this arm in 1858, indicated that the cartridges supplied were reasonably waterproof.

As the linen Gibbs cartridge was used interchangeably with the paper cartridge for that arm, it is assumed that they both had the

same dimensions. However, this might be incorrect. The Gibbs chamber had a straight cylindrical section of the same diameter as the cartridge—0.58 inch (see fig. 17a). Ahead of this was a conical section. The breech block protruded into the chamber so as to leave only 0.6 inch clear, pressing some of the charge back into the recessed breech and forcing some forward. With the paper cartridge this could be done without much difficulty, but a linen case may have had to be made shorter, possibly with a rounded base.

Linen cartridges for the Colt's Army and Navy revolvers were used in the Service at one time.[16] (See pl. 36f, g.)

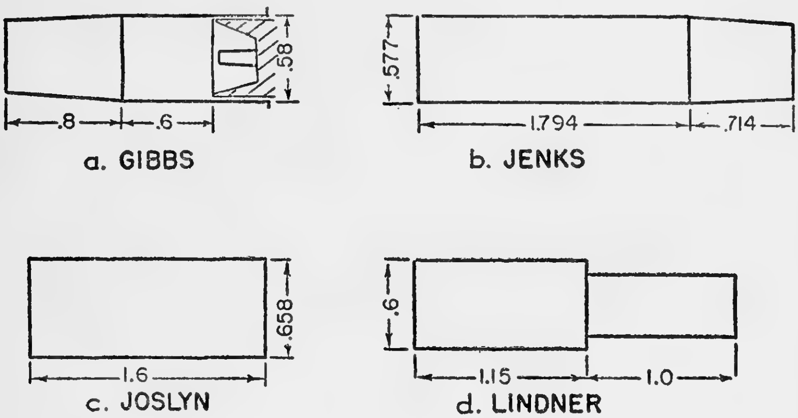


FIG. 17.—Carbine chambers.

Many of the early breech-loading systems were ineffective and were tolerated only in the emergency of war. The Jenks, Union, Gibbs, Merrill, Greene, Model 1859 Joslyn,[17] and Lindner carbines at one time used paper ammunition. The Merrill, Union, and Gibbs types are shown on plate 36, l, m, n; the Greene on plate 30a–e. The others are unknown in detail. However, a description of the respective chambers may help to identify these cartridges, should specimens be found.

The Jenks chamber had dimensions as shown in figure 17b. The Joslyn chamber is shown in c and that for the Lindner in d. The Lindner was loaded from the front; the general proportions of its cartridge would be about the same as those of the more familiar metallic Burnside type, minus the grease ring at the mouth of the case. The Lindner system was used by several European armies. The cartridges for those arms were characterized by a cavity in the base,

in which a percussion (musket size) cap was placed, in a reversed position. When loading it was removed and placed on the nipple.[17a]

Wrapped foil, or foil and paper, cartridges were quite successful in sealing the breech. Those made of foil and paper under Poultney's patent (assigned to him by Crispin, the inventor) were used in large quantities in the Burnside, Gallager, Smith, and Maynard carbines. These types are shown on plate 39g, n, and plate 40b, n. An earlier Smith cartridge had a case of India rubber, with a cardboard wad in the base (pl. 40g–j). It was claimed that these could be reloaded a dozen or more times.[18]

Another metal and paper cartridge was the Jackson, made for Gallager and similar weapons, which consisted of a tinned-iron tube covered with paper (pl. 39p). A few cartridges are found that are made of foil soldered at the seam and soldered to a foil or heavier metal base (pls. 39o, 40l). They resemble the Poultney product minus the paper. Colt made a series of soldered-foil revolver cartridges, attached to the bullet by cement (pl. 38q). This type was patented by Colt and Eley in London in June 1855.[19] It was advertised but never marketed to any extent in the United States.

The large group of skin-, membrane-, or waterproof paper-covered cartridges introduced during the Civil War had little to commend them but their convenience and a certain amount of resistance to moisture. They added nothing to the efficiency of the breechloaders but had considerable value for use in revolvers. These cartridges may be classified in several general types.

Probably the commonest variety was that made by D. C. Sage & Co. They were made under two Hotchkiss patents, the first described as "Waterproof Skin Cartridges" and the second as "Seamless Skin Cartridges." The first (pl. 38c) was made with two strips of membrane wound spirally in opposite directions. The second (pl. 38d) used a 1-piece membrane as the name indicates. Plate 38z, aa, bb, shows other Sage cartridges. Being quite fragile, they were packed five or six in a 2-piece wooden container, with grooves to fit each cartridge. Navy revolver size cost $18 per thousand.

Johnston and Dow's cartridges looked very much like the second-type Sage product (pl. 37g–j), but their paper covering was considerably more substantial. Though they came loose-packed in a paper wrapper, they were seldom broken, while four out of six Sage specimens are now found damaged when the box is opened.

Colt's first skin cartridges used a tough membrane to form a cartridge case very similar to the older paper types, as shown in plate 38i. Though quite durable it is likely that such cartridges would

leave an objectionable residue in the chamber. Colt then tried a thinner material much like that used by Sage. The more commonly seen Colt's combustible type were made from nitrated paper, with a pasted seam at edge and base. They came in wooden boxes much like that previously described. (See pl. 38e.)

Haye's cartridges were standard in the British service for use with Colt's revolvers. The skin-covered cartridge was enclosed in a paper tube, which was torn off by means of a tape before loading. They came in brown-paper bundles of 18, each bundle in a waterproof bag of paper and rubber. As sold commercially in the United States they were packed six in a small carton, labeled "Broux' Cartridges." (See pl. 38j.) Stonehenge [20] said:

> Skin cartridges invented by Capt. M. Hayes, RN, are particularly serviceable with all rifles, which, like this [Prince breech-loading percussion rifle] require the percussion fire to perforate the envelope of the powder. They consist merely of the charge confined to the base of the ball by a fine animal membrane and kept in the cartouche box in a cover of cartridge paper, which is readily torn off by means of a piece of red tape attached to it. Gunpowder thus confined will keep for a long time and the additional expense is so trifling as to be scarcely worth a moment's consideration to the sportsman. They are manufactured and sold by Messrs. Brough and Moll, London.

The Hazard Powder Co.'s cartridges, made under the Doremus and Budd patents, used clear collodian to cover the pressed powder charge. Their appearance was characteristic. (See pl. 37k–p.)

Bartholow's cartridges were quite distinctive also. A shellac-coated cylinder of pressed powder was fastened to a bullet with a strip of silk fabric, also shellaced. (See pl. 37q–w.)

Packages of combustible cartridges are found occasionally, the maker or patentee of which is not identified on the label. Such a cartridge is shown on plate 38w; its package is illustrated on plate 50r. Though this cartridge seems to have a unique feature, which must have been patentable, most unidentified packages contain cartridges that appear to be infringements of the Hotchkiss patents. This no doubt explains the reluctance of the maker to put his name and address on the label.

In addition to the manufacturers named, it is known that Robert Chadwick made packaged ammunition for the Navy Colt and other Service arms.

Relatively small quantities of revolver ammunition were made at Government arsenals. A package from Watervliet Arsenal is shown on plate 50g, the cartridges on plate 38h, y.

When the Civil War began Army regulations listed the types of ammunition and associated stores then on hand. An extract follows:

ARMY REGULATIONS—1861

Powder, Ammunition for Small Arms, etc., and Materials:
Musket buck and ball cartridges for percussion arms
Musket buck and ball cartridges for flint lock arms
Rifle ball cartridges for percussion arms
Pistol do.
Musketoon ball cartridges, percussion
Pistol ball cartridges, flint
Musket blank cartridges
Rifle blank cartridges
Cartridges for Colt's pistol
Musket balls, pressed, for proving muskets
Musket balls, pressed
Rifle do.
Buckshot
Laboratory paper, viz:
No. 1 (musket cartridge)
No. 2 (wrapping)
No. 3 (blank cartridge)
Wrapping paper, No. 2, waxed
Percussion caps for small arms
Percussion caps for Colt's pistols
Percussion primers for Maynard's lock

The Ordnance Manual of 1861 listed the official cartridge specifications then in effect as follows:

	Ball			
	Diameter	Weight Grains	Powder Grains	Wrapper [21] Color
Musket (Expanding ball, 1842)	0.685	730	70	.....
(Round ball, 1842)	0.65	412	110	Green
(Buckshot)	....	...	110	Red
(Expanding ball, 1855)	0.577	500	60	.....
(Blank, 1855)	....	...	60	.....
(Cadet)	0.577	450	50	Red
Carbine, Sharps	0.56	475	50	.....
Carbine-pistol	0.577	450	40	Blue
Revolver (Army)	0.46	216	30	.....
(Navy)	0.39	145	17	Blue

The cartridge usually associated with the Civil War was that for the Model 1855 caliber 0.58 rifle and rifle-musket, which fired a caliber 0.577 "Minié" ball. During most of the war this cartridge was issued and used with another of very nearly the same external appearance. This second type was made up with the Williams [22]

bullet, which was designed to remove powder fouling from the bore of a rifle, a most worthwhile objective in black-powder days. The bullet had a coned zinc washer held to its base by a lead disc and plug (pl. 28d–g). On firing, pressure drove the disc into the bullet, flattening the zinc washer and forcing its edges out against the surface of the bore. Tests of the bullet proved its performance up to the inventor's claims and in December 1861 three million were ordered.

Thereafter, until late in the War, one or more Williams cartridges was put in every package of ammunition for the caliber 0.58 rifle. Ordnance inventories list some in caliber 0.69 also, but I have never seen other indications of the use of that size.[23] Plate 28c, d, shows the usual caliber 0.577 cartridge (for the caliber 0.58 arms) and one with the Type II Williams bullet. The regular bullet is considerably longer and has a sharper point. The space between base of bullet and washer can be felt through the paper. With these characteristics in mind, the two can be distinguished readily. Another Williams bullet was used earlier in the war. Plate 28g shows this cartridge, which can be identified only by examination of the bullet, in which the base assembly of disc and washer is changed. Some of the Williams cartridges were made with red- or blue-stained paper for identification when important. For example, the Union (coffee-mill) machine gun used the Williams bullet exclusively. Apparently the bore-cleaning load was discontinued because the troops were prejudiced against it. They said it damaged the bore, though extensive firing tests did not so indicate. A study of reports of the official tests of the Williams bullets and manuscript notes on them by Master Armorer Allin of Springfield Armory shows that the bullets were highly effective in accomplishing their purpose and were also at least as accurate as the standard type. Smaller calibers were tried experimentally in 1865 (pl. 43n, o).

The regular cartridge for the caliber 0.58 rifle was also used in several other Civil War arms. Among them were the Lindsay 2-shot rifle and the first version of the Billinghurst and Requa "Battery gun."

Another special load for the service rifle contained the "Shaler" sectional bullet. This was intended to provide for the rifle what the old buck-and-ball load did for the smooth-bore musket. However, the Shaler bullet[24] was designed to retain a little more velocity than did the buckshot of the older cartridge. The Shaler cartridge (pl. 28g) was distinctive in appearance. The bullet nose was exposed, and the powder end of the case was closed by a paper disc with a string attached. To load, the string was pulled, opening the end of the cartridge. The powder was poured down the barrel; then the 3-piece

ball was inserted still covered by the cartridge paper. As with the Williams bullets, parts of the Shaler projectiles can usually be found mingled with other Civil War battlefield souvenirs.

Some time after the war, the Shaler bullet was mentioned in official correspondence: [25]

National Armory, August 13, 1878

Respectfully returned to the Chief of Ordnance,

The efforts that have been made, heretofore, to render the rifle more effective by substituting multiple or buck shot for a single projectile, for short distances, have not been successful. The "Shaler sectional bullet" tried during the late war, in the rifle musket, was of this class, but did not meet with favor when tried in the field. I am not prepared to say that Captain Wright's cartridge containing three round balls may not under certain circumstances be effective, and if there is any way in which they can be tested in service in the rifle and carbine, I would recommend that a number be issued for this purpose.

The changes proposed, of increasing the weight of the revolver and reducing the number of chambers in the cylinder to enable it to carry the same cartridge as the rifle and carbine, seem to me to be objectionable and not warranted by the good to be obtained. The revolver being intended for hand to hand combat, should, in my opinion, not have long range unless this can be obtained without sacrificing lightness, and without reducing its number of charges.

The pistol and unexpended cartridges will be returned to the Ordnance Office by express today.[26]

J. G. Benton
Lieutenant-Colonel Ordnance, Commanding

While the Civil War was in progress the claim was made in the North that the Confederates were using explosive bullets, certainly a shocking accusation. After the war a Congressional Committee cleared the South of this charge, and the whole affair was dismissed as wartime propaganda. Explosive bullets were really used during the war, but by the North as well as the South. European observers were so impressed by the performance of such ammunition that a convention held at St. Petersburg in 1868 outlawed the use of explosive filler in projectiles weighing less than 400 grams. The United States did not subscribe.

Several years before the Civil War Delvigne Jacobs and others in Europe described explosive projectiles for use in big-game hunting and against ammunition wagons and similar military materiel.[27] In 1862, in a text used to instruct West Point cadets, Benton [28] said:

Percussion bullets may be made by placing a small quantity of percussion powder, enclosed in a copper envelope, in the point of an ordinary rifle-musket bullet, or by casting the bullet around a small iron tube, which is afterward filled with powder and surmounted with a common percussion cap. The impact of the bullet against a substance no harder than wood [or bone] is found to

ignite the percussion charge or cap and produce an effective explosion. These projectiles an be used to blow up caissons and boxes containing ammunition, at very long distances.

With projectiles of the first class mentioned, General Jacobs of the British Army blew up caissons at 2,000 yards (pl. 28c). An American modification of the same idea, patented by Mead, substituted a copper caliber 0.22 rim-fire cartridge case for the plain tube (pl. 28a). Some retained their normal rim priming and black powder charge. Others were completely filled with priming compound.

The Union Army tried at least three different types of explosive rifle balls. One, the "Lossing,"[29] was of the second type described by Benton. I have not been able to find a specimen.

The Gardiner explosive bullet (pl. 29f), patented in 1863,[30] was of a different design. A copper vessel, like a miniature bottle, was cast into the bullet with its neck opening at the bullet's base. The cavity was filled with powder, and the neck was plugged with slow-burning powder. On firing of the rifle the powder in the base of the bullet was ignited, and when it had burned through to the inside the bullet exploded. This was timed to occur 1¼ seconds after firing.[31] It appears that while in flight this bullet had a tracer effect—probably the first on record—but its possibilities went unnoticed for 40 or 50 years. The Gardiner bullet can be recognized by the nozzlelike projection at the base, communicating with the interior. Some are now considerably corroded around the fuze hole from deterioration of the powder within.[32] Ordnance records show that a total of "33,350 Gard[i]ner's explosive bullets or musket shells . . ." were issued to troops. They were used in calibers 0.54, 0.58, and 0.69. The caliber 0.54 bullet weighed 363 grains, the caliber 0.58 451 grains. This bullet, as used by Federal troops, was made up in a distinctive cartridge, having the smooth front portion of the ball protruding from a pasted paper cylinder that lacks the familiar pigtail of standard Service ammunition. (See pl. 29d.)

It is recorded in the *Medical and Surgical History of the Civil War* that some 10,000 rounds of this ammunition were captured and soon thereafter used against Union troops. This incident led to the story that the Confederates never made such bullets, but only used some they had captured. H. E. Hayden wrote to Jefferson Davis on September 15, 1879, in an effort to pin this story down. He wrote, in part:[33]

I wrote you as to whether the Confederacy had ever authorized the use of explosive or poisoned rifle balls as charged by Lossing. U. S. Medical reports contain no records and the archives at Washington contain no evidence of Con-

federate use of such missiles. Records in the Adjutant General's office show that the U. S. did purchase 110,000 rounds of the Gardiner musket shell; that 35,000 rounds were issued to the U. S. Armies; that 10,000 rounds of these were abandoned in Virginia and that 10,000 rounds were used at Gettysburg (note: Gardiner bullets have been found on the Gettysburg battlefield). I secured from the U.S. Ordnance Bureau 12 Gardiner Musket Shell, the pattern of which I note. General E. L. Dana, USA, informed me that the Confederate troops did fire explosive balls at his command, and his ordnance officer told me they were cartridges lost the day before.

If Mr. Davis replied, I was unable to find his answer. However, the Confederate Government did make and use such ammunition.

In his memoirs Grant said,[34] "The enemy used in their defense (Vicksburg) explosive musket balls no doubt thinking that, bursting over our men in the trenches, they would do some execution; but I do not remember a single case where a man was injured by a piece of one of these shells. Where they were hit and the ball exploded, the wound was terrible. In these cases a solid ball would have hit as well. Their use is barbarous because they produce increased suffering without any increased advantage to those using them."

Sworn testimony of several Confederate officers gives certain details:

Lt. Beverly Kennon, CSN—"I also had shells made for the muskets and Mississippi rifles—September 19, 1862." [35]

Commander Minor—"Lieutenant Kennon ordered the manufacture of 100,000 rounds of musket shells at 15 cents apiece, of which 39,000 rounds are now at the Naval Laboratory at Atlanta, Ga. Many were lost in New Orleans. They were of no use in the Navy and a dangerous projectile, and many exploded in the operation of ramming. Their sole value lay in the components of lead and fulminate of mercury. As Ordnance Officer I would not authorize their use at any time." [36]

Commodore Preble—"C.S. sharpshooters used explosive balls. Dr. Burton has one. A conical ball, pointed and charged with fulminate." [37]

Some of the CSA explosive ammunition has finally been identified. It appears to be an attempt to copy the Gardiner bullet, leaving out the copper insert. The projecting tube at the base is also omitted. Its lack would very likely cause a considerable number of muzzle bursts in firing the round. It is possible, of course, that this bullet was earlier than the Gardiner and that the latter was a refinement; this is suggested by the fact that they were in manufacture a year before the Gardiner patent date and that some were presumed to have been captured at New Orleans. The specimens identified are caliber 0.577. (See pl. 29 for cartridges and bullets.) It is evident from the testimony that caliber 0.69 was also made, and it is likely that the bullet mentioned by Lieutenant Kennon as for the Mississippi

rifle was caliber 0.54. The fulminate in the cavity has caused deterioration of the lead in most specimens examined. This caused the thin base of the ball to expand and crack (pl. 29j). Some cartridges show swelling through the paper, with small tears and a visible ridge at the junction of ball and powder charge. The package (pl. 47h) was marked "cal. .577 Enfield" in ink. This variation from the CSA regulation that required caliber and place and date of manufacture to be marked on each package was no doubt to avoid publicity. The identification was by the special string used in tying. This consisted of two colored strands, one purplish, the other brown. Details of the paper, caps, and method of wrapping suggest Richmond Arsenal as the probable place of manufacture.

Another odd projectile used in the Civil War was that patented by Mefford.[38] This was a subcaliber bullet for use in caliber 0.69 arms. The bullet (pl. 26h) was of about caliber 0.50 size, smooth, and attached by a peg to a hard wood sabot. The latter was a loose fit in the smooth-bore musket. The sabot had spiral grooves along its sides, supposedly to cause rotation in flight. A buck and ball load, having three buckshot separated by thin wads from a Mefford projectile, is also known (pl.26g). What these were for is a puzzler. Until the buck-and-ball load turned up, it was believed the Mefford ball was for target practice at reduced ranges. The buck throws that consideration out. Mefford also had a patent for a subcaliber artillery projectile, which he described as for "high velocity" to obtain penetration of earthworks and other fortifications. Perhaps this applied, also, to his musket cartridge, but again the buck combination does not seem right.

The powder charges and bullets used in the Colt Army and Navy size revolvers varied greatly. Most of the cartridges are difficult to distinguish without breaking them up and weighing the components. However, the type of bullet used serves to date the caliber 0.44 specimens fairly closely (pl. 36,o).

The Model 1847 "Walker" Army revolver was designed to use either a round 146-grain (48-to-the-pound) ball or a ½-ounce conical ball loaded with loose powder from a flask. However, the round ball was not made up into cartridges. The standard cartridge contained an elongated ball (cast by the issue mold) of 218 grains (32-to-the-pound) and 1½ drams (40 grains) of rifle powder. The ball was of the "Picket" shape popular in those days. As its widest point was at its base, this ball proved nearly impossible to load so that its axis would be in the center of the bore.

When the Navy revolver was introduced, in 1851, a new bullet

shape came with it. This had a short "heel" section next to the base of less than chamber diameter so that it could be started into the cylinder easily and accurately. The same shape was adopted for the caliber 0.44 size bullet. Dragoon revolver cartridges are shown in plate 36p, q, r.

With the new Army model, in 1860, came another bullet improvement. This had grease grooves added. The original "Navy" load was three-quarter dram (20 grains) of powder with an 81-grain (86-to-the-pound) round ball or a 140-grain (50-per-pound) conical ball. The 1860 Army model used at first a powder charge of 25 grains and either a 146-grain round ball or a 212-grain conical ball. Plate 36s shows a very similar cartridge, with 216-grain bullet. Plate 36i shows a Navy cartridge of about 1862, having slightly different weights of components than had the original load mentioned, though the difference in appearance would not be distinguishable.

Very little material on the subject of Confederate arms and ammunition has been available for study. Part of an official publication [39] is reproduced below:

Ammunition for Small Arms now used in the C. S. Service

ARMS	Calibre	Weight of ball grains	Diameter of ball inches	Charges grains
Belgian rifle	.70	738	.675	80
Mississippi rifle	.54	470	.525	70
Rifle musket	.69	738	...	80
Rifle "	.58	500	.562	75
German rifle	.69	738	...	80
Enfield rifle	.57	540	.562	70
Smooth bore musket (ball)	.69	400	.650	100
" " " (buck and ball)	.69	...	...	110
English smooth bore musket	.75	480	...	110
Hall's carbine	.54	228	...	60
Merrill's carbine	.56	430	...	50
Sharp's carbine	.52	480	...	60
Burnside's carbine	.56	385	...	75
Colt's revolving carbine	.56	420	...	60
" " "	.44	250	...	35
Maynard's carbine	.51	345	...	55
" "	.37	156	...	25
Colt's army pistol	.44	250	...	30
" navy "	.33	145	...	17
Horseman's pistol	.54	228	...	30

Bullets for the military service are made by pressure. One press is capable of making 3,000 bullets in an hour. Some are also cast in moulds, and afterwards *swaged* in a die to the proper size and shape.

Cartridges.—The cartridge is composed of the *bullet* and the *cylinder* which contains the powder. The cylinder is now attached to the bullet without a wrapper or twine, by being compressed in an incision, by machinery, in its base.

Pistol cartridges.—The powder cylinder of Colt's cartridge is made of combustible paper (prepared after the manner of gun cotton); it is attached to the base of the ball by gum, and is inserted in the piece entire.

Percussion caps.—The cap for small arms is made of copper; it is very slightly conical, with a rim at the open end for convenience in handling. The caps are formed by a machine which cuts a star or *blank* from the sheet and transfers it to a die in which the cap is shaped by means of a punch. For use in Boughton's machine, the copper is first cut into strips, from which the blanks are cut and the caps formed; Wright's machine cuts the blanks from the whole sheet and forms the cap. The first machine makes 2,196 caps, the second, 2,314 caps, from a sheet of the size above mentioned. Each machine can make about 5,000 caps an hour.

The powder with which the caps are charged, consists of *fulminate of mercury,* mixed with half its weight of saltpetre. Each cap contains *half a grain* of percussion powder, which is protected from moisture by a drop of varnish.

The *C.S. bullet* is a cylinder surmounted by a conoid, weighs 550 grains, and has three grooves around the bore to hold the grease for lubricating and to guide the bullet in its flight, preserving its point foremost.

The *English bullet* (known as the Pritchett bullet) has a perfectly smooth exterior. A conical wedge of boxwood is inserted in the cavity of the bore, chiefly to preserve its form in being transported.

Charge of powder.—The charge of the old smooth-bored musket was from one-half to one-third the weight of the projectile. The charge for the elongated bullets varies from one-tenth to one-seventh the weight of the projectile.

The cartridge cylinder is attached to the bullet without a wrapper or twine by being compressed in an incision, in its base.

Items k to o on plate 33 illustrate the type of cartridge mentioned in the last paragraph. This was developed at the Richmond Arsenal by F. J. Gardner.[40] As most Confederate ammunition was made in the old conventional manner, it is a fair guess that shortage of machinery caused the Gardner method to be abandoned.

A number of Confederate cartridges are shown on plates 32 and 33. For the most part these were made in the same manner as the standard United States Army ammunition of that period. For this reason positive identification of specimens is difficult unless they are from labeled packages, as are those illustrated. There are recognizable minor differences which serve to distinguish some of these from United States types. Color and texture of paper, type of string, length of pigtail, and other details differ. Inasmuch as such variations are not well depicted by photography, a physical comparison is necessary for certainty.

During the Civil War a great impetus was given to the invention of improved, or in some cases simply different, types of firearms. With the urgent need for weapons, a "screwball" inventor could get an order for at least a few hundred of his proposed arms. The outstand-

ing feature of many of these was their ingenuity in evading patent claims of other systems. However, much real progress resulted, even though obsolete weapons of all sorts had to be retained in service.

As a step in the direction of more effective breechloaders, arms were made that used metal-cased ammunition but that required an external ignition system. The best known of this type were the Burnside, Maynard, and Gallager carbines.

Tinned Burnside cartridges (pl. 39i) were made at Frankford Arsenal in 1861 and later.[41] Some silver-plated cases were tried. The usual form was that shown on plate 39j, with a brass case. The swelled portion at the case mouth contained lubricant. An earlier variety had a longer case (pl. 39h).

The brass cartridges for Gallager's carbine were the same shape as the Poultney-patent cartridges for that arm. (See pl. 39q, r.) A variant form had a paper lining inside the case. With these types of action, the flame from the cap had to penetrate a comparatively long channel to reach the powder, causing a considerable percentage of ignition failures from fouled vents. Otherwise these cartridges performed their function of sealing the breech quite well.

Maynard cartridges were made from brass tubes soldered to perforated brass discs. (See pl. 40c–f.) Maynard submitted a modification of this cartridge for 1866 Army tests, in which, by adding a fulminate pellet between the bottom of the case and a copper cover, he achieved a self-contained cartridge (pl. 43i).

The next great step in improvement was the combination of all cartridge elements in one case. The incorporation of the primer into the cartridge reduced the number of motions required in firing and greatly increased the efficiency of firearms. In some types the priming composition was introduced into the folded rim of the head by swirling, as in the Smith & Wesson, Spencer, and other so-called rimfire cartridges.

In the pinfire cartridges a primed cap was placed inside the case; a short stiff wire in contact with the cap projected outside, to be struck by the hammer. Plate 41d–f shows pinfire revolver cartridges used in personal arms. Both 9-mm. and 7-mm. cartridges were supplied by the Army and listed as official types.[42] The 12-mm. nominal size of pinfire revolver ammunition applied only to the case diameter, or chamber size. The bullet and the revolver barrel of most of them measured only 11 mm.

Center-fire cartridges were primed either externally or internally. This kind of ammunition did not become established in the United

States until after 1865, but two different French types were used in Civil War revolvers. Both were inside primed. The Perrin cartridge (pl. 41g) had a slight rim for positioning. The inside anvil was H-shaped. The Rafael cartridge (pl. 41h) had a straight case, positioned only by the front of the chamber which was not prominent. This no doubt tended to cause misfires. The anvil was a double H. Both of these cartridges, like the 12-mm. pinfire, had bullets of only 11 mm., the bore diameter, but were called 12 mm.

A few Smith carbines were made to use the copper Crispin cartridge (pl. 40p–s). This had a flange near the center of the case that acted as a gas check and contained the priming composition. Actions adapted to this type of ammunition had chambers opening at about the center.

A good description of the American rimfire cartridges of the Civil War years is found in the report on the Paris Exhibition of 1867.[43] The report quotes a paper read by Captain O'Hea before the Society of Arts, of London:

> The American is a simple, metallic cartridge, consisting of four parts, namely, the shell, the fulminate, the charge of gunpowder, and the bullet. The shell is formed from one piece of soft copper—is without joining or welding of any kind, being punched or plugged from the solid metal by machinery, and is, as nearly as possible, of equal thickness throughout, for the purpose of equal expansion. The means of ignition is in the shell, round the rim at the base, and when loaded with the charge of gunpowder, this shell is made to grip the projectile so as to unite it with the gunpowder and fulminate in one compact body. The projectile is solid, and composed altogether of lead. In addition to the small number of its component parts, this cartridge has much to recommend it. It is impervious to moisture, and may even be used after immersion in water. It is gas-tight, for the shell expanding with the combustion of the charge, combined with the resistance offered by the initial movement of the bullet, completely seals the breech, and thus effectually prevents the escape of gas breechwards. It has the additional advantage, that the copper shell can be reformed and reloaded after the contents have been discharged. The original shape of this cartridge case was cylindrical, with a projection at the base for the fulminate, and to help the extraction of the expanded shell; but some modifications have been brought into use with particular arms, among which may be mentioned the invention of General Roberts. The peculiarity of this cartridge is, that the cylindrical portion of it, which is larger than the bore of the arm, extends into the barrel but a short distance, when the diameter of the chamber, as well as of the shell, lessens slightly, until the latter joins the bullet. This facilitates the extraction of the expanded shell, causes more even expansion, and enables the cartridge to contain a somewhat increased charge of powder.
>
> The "Peabody," "Cochran," and "Hammond," rifles, . . . are the only American breech-loaders I have seen using a metallic cartridge, with a charge of fifty-five or sixty grains of powder. However, this fault in the American cartridge could easilly be rectified. Another peculiarity of American arms using the

metallic cartridge is, that the diameter across the base of the projectile used is always greater than that of the bore of the rifle, measuring from land to land, or the raised portion of the rifling.

Polygonal rifles, such as the Whitworth, are not used in the United States, consequently the bullet is forced to take the grooving as it passes through the barrel. This has its advantages. It is impossible the bullet can strip, avoid taking, or leaving the grooves, and I have seldom heard of fractures.

In concluding his remarks on cartridges, Captain O'Hea said:

In the metallic [cartridge], there appear to me in addition to the great essential of a sufficient charge of powder for the diameter and length of the bore and weight of projectile, five other requisites for ensuring a favourable result, or return, in the use of metallic cartridges.

1st—that the shell or case be made of such description, or substance, as will ensure its expanding, or contracting, but not fracturing. 2nd—that the shell be formed of one piece, if of soft metal, and of one fold, if of harder or medium metal, and that it be gas-tight, limited as to power of and space for expansion. 3rd—that the expansion of different metals being unequal, the insertion, in any part of the shell, or any foreign piece of metal, or even of a distinct piece of metal of the same kind, be avoided, as tending to weaken or fracture it, and increase the cost of manufacture; the fulminate ought also to be placed somewhere on the inner surface at the base of the shell no matter how that surface may be modelled. 4th—that the shell grip the bullet, so that the cartridge may be impervious to moisture, and that the expansion of the shell may be compulsory, or inevitable on the expulsion of the bullet. 5th—that the base of the projectile be of such diameter that it is not only forced to take the grooves as it enters the rifled portion of the barrel, but that all chance of gas escape round the bullet is impossible, and that the latter contains no foreign substance or body that would make it liable to fracture on being driven into the bore, or make the manufacture of it complicated or difficult under any circumstances.

These requisites, with the exception of a "sufficient charge of powder"—a defect easily remedied—are all combined in the American cartridge, already referred to.

Most cartridge collections contain many unidentified rimfire specimens. In studying the rimfire ammunition of the Civil War period the first thing that strikes one is the great number of apparent contradictions in the evidence available. The breechloaders involved usually had a chamber a little larger and a bore a little smaller than the projectile. The caliber of the bore was used in referring to the arm, and often the bullet diameter was used in describing the cartridge. Thus a certain amount of confusion was to be expected, such as "Caliber 46/100 cartridge for caliber 44/100 Army revolver." When a cartridge was listed as for the "caliber 0.58 Colt's rifle," it was uncertain whether the caliber 0.56 revolving rifle or the caliber 0.58 single-shot rifle-musket was intended. This sort of thing carried over into the rimfire class of weapons.

Several of the breech-loading systems used during the Civil War were tried on a small scale a few years before. In many instances the first type used a paper cartridge and the later version a rimfire. The Joslyn carbine is an example of this. With other systems, as the Starr carbine, the change to metallic ammunition was made during the war. Thus the same caliber weapon might be listed as caliber 0.54 or caliber 0.56, depending upon the type of ammunition.

In the early 1860's there was as yet no attempt to standardize rimfire ammunition as to sizes. It had been customary for the Army to order ammunition with the weapons. Therefore, to insure getting the future replacement business, arms manufacturers usually managed to adapt their weapon to some special cartridge, different in at least some small particular from other makes. Toward the end of the war an attempt was made to reduce the number of different cartridges in use, and this succeeded to a certain extent, as will be detailed later. Even after this partial standardization, arms manufacturers continued to label their ammunition "For use ONLY in . . . arms." That practice further complicated the work of the individual who tries to unravel the story. Most of the different types of carbines of the Civil War did have distinctive ammunition at one time or another. Some would work with several different loads, which did not really fit the chamber properly, but could be fired.

Ordnance Memorandum 1 [44] contains a list of carbines in use in 1863, together with a tabulation of their ammunition. The rimfire types mentioned are as follows:

Arm and Type	Diameter of Bore	Diameter of Chamber	Diameter of Ball
Ballard's Carbine, M1864	0.42	0.42	0.44
Ballard's Carbine O.M.	0.54	0.56	0.56
Ballard's Rifle	0.44	0.46	0.45
Ball's and Palmer's Carbine	0.41	0.44	0.44
Henry's Carbine [?]	0.44	0.46	0.46 [1]
Henry's Rifle	0.42	0.44	0.44
Johnson's Carbine [3]	0.44	0.46	0.45
Joslyn's Carbine	0.54	0.56	0.54
Remington's Carbine, M1864	0.42	0.44	0.43
Sharps and Hankins' Carbine	0.52	0.56	0.54
Sharps and Hankins' Rifle	...	...	0.55
Spencer's Carbine and Rifle	0.52	0.564	0.55 [2]
Starr's Carbine, N.M.	0.52	0.57	0.56
Warner's Carbine, M1863	0.50	0.52	0.515

[1] Repeating. 12 shots.
[2] Can also be used in Starr's new model carbine.
[3] Unidentified carbine.

For some of the systems, as the Sharps and Hankins, the carbine cartridge had a slightly smaller ball and a little less powder charge

than did the rifle, presumably to reduce the recoil with the lighter carbine. Most of the Ball and Palmer carbines were made in 1865, and these later models were caliber 0.50 and used the 56/50 Spencer cartridge. That there was a distinction between a Henry carbine and a rifle was news to me. The usual Henry rifle had a 24-inch barrel. However, L. D. Satterlee has heard of a Model 1865 Henry with an 18-inch barrel. This was intended for use by mounted troops and was adapted to carrying in a saddle holster.

One of the first Service records of firing of rimfire weapons is contained in Navy test reports of 1862. The Henry cartridges as recorded at that date (pl. 41m) contained the following components: Ball—216 grains, powder—25 grains, tallow—2 grains, case—50 grains, fulminate—2 grains, Total—295 grains. The cartridge most used during the war had a pointed bullet (pl. 41n). In 1862 the charge of the Spencer cartridge was 34 grains.

Brand's patent breech-loading musket was tested also. It employed a rimfire cartridge with a 37-grain case containing 38 grains of powder and either a caliber 0.54 497-grain conical ball or a 459-grain round ball. Buck-and-ball loads were tried. The following year (1863) two new Allen & Brand arms were tested, calibers 0.54 and 0.58. The latter used a cartridge weighing 501 grains. The former had a case weighing 62.9 grains, ball 473.4, and powder 38.4 grains, a total of 574.7. There is a record of the Eleventh Massachusetts Volunteer Regiment receiving 30,000 Allen & Brand cartridges and 111 of the caliber 0.54 muskets in 1863. This is one of the unidentified types.

An Ordnance board, convening on September 24, 1863,[45] recommended changes to reduce the number of types of ammunition required for carbines. There had been a great variation in the relationships of powder charges to bullets, some loads being comparatively weak. The board suggested that a minimum charge be established at one-tenth the weight of the ball. They also recommended that Sharps, Gibbs, Starr, Spencer, Joslyn, Sharps and Hankins, and Ballard carbines all be made with bores of 0.52 inch. The first three were to use the Sharps paper or linen cartridge, the last four to use the copper Spencer cartridge. No changes were recommended in the cases of several carbines "using peculiar cartridges not adapted to interchangeability."

Rather than standardize on an existing type of ammunition, the Secretary of War asked the individual members of the board to express their opinions as to an *ideal* caliber.

Lt. Colonel Hagner suggested caliber 0.44, mentioning that the

State of Massachusetts had ordered Spencer carbines in that caliber (pl. 41j).

Major Dyer recommended caliber 0.50, but as most of the carbines in service exceeded this he would agree to acceptance of caliber 0.52.

Major Laidley suggested caliber 0.50. He stated that a larger ball was too short for its diameter to give good results, while a smaller one would be too long, causing sticking in the chamber and increased manufacturing costs. He tabulated several carbine bullets and cases then in use, as follows:

Balls:	Diameter	Length	Weight
Sharps	0.54 inch	1.0 inch	456 grains
Burnside	0.55 "	.80 "	380 " [Poultney type]
Maynard	0.50 "	.76 "	335 "
Sharps and Hankins	0.53 "	.93 "	462 "
Williams Ball	0.45 "	1.1 "	413 "
New Proposed	0.50 "	.95 "	400 "
Cases:			
Sharps and Hankins		1.175 "	
Gallager		1.65 "	

Captain Benton recommended caliber 0.44.

Captain Benét suggested caliber 0.50, with a bullet not over 400 grains and about 1 inch in length.

Captain Crispin recommended caliber 0.44 with a 50-grain charge and a 320-grain bullet.

Captain Balch recommended caliber 0.50 and mentioned that at that time—October 9, 1863—there remained in service only about 3,000 carbines using paper ammunition.

General Ramsey preferred caliber 0.44 and mentioned use of three 140-grain balls in one cartridge (a perennial idea). His letter follows:

Ordnance Office, War Department,
Washington, October 20, 1863

Hon. E. M. Stanton,
Secretary of War:

Sir: In presenting herewith the individual opinions of the officers constituting the Ordnance Board for the subject of the best caliber for the bore of small arms to use the copper cartridge, I beg leave to avail myself of the occasion to express my own preference in favor of the caliber .44, and for the reason that, in addition to effectiveness of its elongated projectile, a cartridge containing three spherical balls, weighing 140 grains each, could be introduced, and which would prove most effective up to the distance of at least 150 yards. The weight of the entire cartridge need not exceed 540 grains. Firing on horseback, and often at speed, does not present the best elements for accurate firing, and I am of opinion that the introduction of the buckshot cartridge, as suggested, would prove a valuable auxiliary to the elongated ball.

As these cartridges would only be used under favorable circumstances, the additional weight imposed would be of no great matter.

Respectfully, etc.

GEO. D. RAMSAY,
Brigadier-General, Chief of Ordnance

On November 24, 1863, Springfield Armory was directed to make 12,000 cartridges each for the Joslyn, Sharps & Hankins, and Ballard carbines, 2,000 of each type to be of the following powder capacities: 35, 40, 45, 50, 55, and 60 grains. Six carbines of each type were to be purchased, one to be chambered for each cartridge size. The caliber was first designated 0.50 but was almost immediately changed to 0.44. Some of this series are shown in plate 43.

Drawing of copper cartridge cases had not developed far enough so that high-capacity cases could be made without great difficulty. As the war would not wait for longer caliber 0.44 cases to be worked out, the Ordnance Department decided to stick with the caliber 0.50 for the time being. In the fall of 1864 the 56/50 (caliber 0.50) cartridge was designed at Springfield. A letter written on November 11, 1864, authorized the Spencer factory to change their model accordingly. The new 56/50 cartridge was used in Spencer carbines made by both Spencer and Burnside. No Spencer rifles were chambered for it during the war. All the Spencer rifles and all the carbines before the new 1865 model used the original 56/56 (No. 56) cartridge. These arms all had caliber 0.52 barrels—the original Spencers used Sharps barrels, with six grooves. The new model used the 3-groove Springfield rifling system, but after the war Spencer returned to the 6 grooves formerly used. Postwar commercial models used the 56/52 cartridge, which was interchangeable with the 56/50. The Government did not purchase the new 56/52 size, as large stocks of the 56/50s were left from the war.

With the new caliber 0.50 cartridges available, orders for new-model carbines of various makes specified its use. To avoid delays in much-needed production, old-type carbines continued to be made in the original calibers. Some of the new models, such as the Ball and the Palmer, failed to get into production in time to be much of a factor in the war.

Where only minor rechambering was involved, certain carbines were altered to fit the new 56/50 ammunition. Warner carbines were reamed out slightly and others, such as the Starr and Ballard, were able to use the new ammunition without change, though it did not fit perfectly.

Most of the rimfire cartridges used in official Civil War arms are

illustrated on plate 41. Figure p is the caliber 0.45 cartridge for the Ballard rifle. Figures k, l, o, and n are caliber 0.44 types, for the Howard rifle (also fits the Ballard), Ballard carbine (also fits other carbines), Ball or Palmer carbines, and Henry rifle respectively. Figure q shows the caliber 0.46 cartridge for the Remington carbine. Figure s is the 56/50 cartridge for Spencer and other arms, and u, v, w, and x are some of the variations of the older 56/56 Spencer. Figure y shows the caliber 0.54, "No. 56" cartridge for the Joslyn arms. The Sharps and Hankins cartridge is represented by figures z, aa, and bb. Figure t shows the No. 56 Ballard cartridge. This and the Sharps and Hankins types shown (there were others) both had linen patches on the base of the bullets, the patch coming flush with the mouth of the case when the bullet was seated. One variety of Sharps and Hankins bullet had a round post in the middle of its base to center the patch, which had a corresponding hole.

Several smaller rimfire cartridges were used in personal arms. Among them were the calibers 0.22 and 0.32 Smith and Wesson revolvers and the caliber 0.44 Hammond pistol. These are shown on plate 41a, b, i. The Prescott caliber 0.38 Navy revolver (pl. 41c), used unofficially, fired a cartridge similar to the No. 62 Allen rifle cartridge.

The uncertainty of supply of metallic cartridges brought about the use of auxiliary chambers for emergency loading with loose powder and ball. Examples of these for the Hammond pistol and for the 12-mm. Lefaucheux revolver are shown in plate 42h.

The machine guns used in the Civil War were of two types as to ammunition. Some fired the regulation or other paper cartridges in a reloadable chamber. Others had special cartridges. The gun most used was that known as the "Union repeating rifle gun" or the "coffee-mill gun." These hopper-fed guns handled a special caliber 0.58 rifle cartridge with little apparent difficulty. The cartridge used a reduced load and lighter bullet of the Williams type, shown in plate 42b. The Rafael gun employed a nonstandard paper cartridge, with a 93-grain charge. No specimens are known to have survived.

The Billinghurst and Requa "battery gun" as first constructed used paper ammunition, but it failed to function well. Later models employed a special brass cartridge with separate percussion cap ignition (pl. 42c) and worked well with that system. The cartridges were held in a long metal strip made like a piano hinge.

An iron cartridge found on a Civil War battlefield may be the type

used in the first Gatling guns, which were fired experimentally during the War. It answers the general description of the Gatling cartridge (pl. 42a). The ignition was external, the case being built up in a manner similar to that used in the Maynard ammunition—a tube with a perforated head attached by soldering.

Plate 42 illustrates a number of special cartridges used in machine guns or other patent arms during the Civil War. The 1-inch rimfire Gatling cartridge (pl. 42d) was made at Frankford Arsenal in 1865 for tests of new guns in that caliber. A few Gatlings in caliber 0.58 rimfire (pl. 42f) were also tried. The brass Cofer cartridge with nipple (shown on pl. 42g) was patented in the Confederate States on August 12, 1861. It was used in a specially designed split-cylinder revolver. Items i, j, k, and l show ammunition types used in various front-loading and other revolvers designed to evade the S&W patent on rimfire cartridges. These arms were carried by many individuals as personal weapons, though the ammunition was not listed in Government stores.

Plate 43 shows several cartridge types used in trial or experimental arms. The Meigs cartridge (pl. 43m) is center-primed by an internal method, upsetting a small cup in the base. The Maynard "mule-ear" specimen (42h) was a caliber 0.58 version of the larger cartridge of the 1857 trials (42c). This was submitted about 1863. Later (1866) Maynard improved this type by incorporating a primer in the base and covering it with a large saucerlike disc (42g, j). A similar modification was presented for the M1865 Maynard carbine (42i). Late in the war, Springfield Armory began development of experimental cartridges in calibers 0.50 and 0.44, as previously mentioned. Some of these, in various bullet and powder weights, are shown in plate 42p–w. The arms for the Williams-bullet cartridges in plate 42n, o, are unknown. This may have been the item mentioned in connection with the standardization attempt in 1863.

FOREIGN CARTRIDGES USED IN THE UNITED STATES

During the wars with England, cartridges were made in the United States to fit English weapons in use by United States troops. Large quantities of foreign small arms were purchased abroad by both North and South during the Civil War. Some cartridges were obtained with the arms and large additional quantities were made in America.

A table published in 1803 [46] lists English cartridges of about the specifications in use during the Revolutionary War:

Arm	Bore Diameter	Weight of Ball: Proof oz.	dr.	gr.	Service oz.	dr.	gr.	Powder Charge dr.
Wall piece	0.98	2	8	8	2	5	7	10
Musquet	0.76	1	6	11.5	1	1	12	6
Carbine	0.61	0	14	13	0	12	11	4
Pistol (common)	0.58	0	8	15	0	7	4.5	3
Pistol (carbine)	0.66	0	14	13	0	12	11	3
7-barrel gun	...	..	..	..	..	..	..	1.5

Additional information was given by Duane [47] in 1810. He mentioned that French musket-ball cartridges were capped with flannel. His tabulation, reproduced below, indicates that the English ammunition was packed in barrels or kegs, unlike the American custom of packing in tinplate-lined boxes.

Arm	Powder: Drams	Grains	Balls/Lb.	Caliber	No./Bbl.
Wall Piece	10	273	$6\frac{3}{4}$	0.89	1400
Musquet	6	163	$14\frac{1}{2}$	0.68	2100
Carbine	4	109	20	0.60	2853
Carbine-Pistol	3	82	20	0.60	4400
Common Pistol	3	82	34	0.51	2000 [1]
7-barrel Guns	$1\frac{1}{2}$	41	$46\frac{1}{2}$	0.46	1000 [2]

[1] Half barrel.
[2] In kegs.

Arm	Musquet Charges—Powder oz.	dr.	gr.	Total Cartridge oz.	dr.	gr.
English	..	6	..	1	9	11
Hessian	..	7	10	1	7	2
Austrian	..	6	13	1	6	4
Dutch	..	10	$10\frac{1}{2}$	1	12	0
French	..	7	$4\frac{1}{2}$	1	6	0

Piobert [48] lists the French arms from the Model 1822 through the remainder of the flintlock types. He also tabulates the other comparable European arms. Many of those he describes were later converted to percussion and sold in America during the 1860's.

Busk [49] says that the service charge for the Enfield, as adopted by England in 1853, was $2\frac{1}{2}$ drams (or rather more than 68 grains) of fine-grained powder. The weight of the ball was 530 grains, its diameter 0.568 inch. The bullet size was later reduced to 0.550 inch to facilitate loading.

The British Service ammunition in 1854, as reported by Scoffern,[50] was as follows:

Model 1842 percussion musket, caliber .753, with 30-inch barrel; Spherical bullet of 490 grains ($14\frac{1}{2}$/lb.); $4\frac{1}{2}$ drams of FG powder, cartridge reversed in loading. Effective range 200 yards. Two rounds per minute.

TABLE 4.—PIOBERT'S TABLE OF FRENCH ARMS IN USE IN 1836

(Quantities in inches, grains, and pounds)

	Muskets			Musketoons			Pistols	
	Infantry (M1822)	Voltageur (M1822)	Dragoon (M1822)	Gendarme (M1825)	Artillery (M1829)	Cavalry (M1822)	Cavalry (M1822)	Gendarme (M1822)
Diameter of Ball	0.642	0.642	0.642	0.642	0.642	0.642	0.642	0.578
Weight of Ball	395	395	395	395	395	395	395	285
Caliber of Bore	0.689	0.689	0.673	0.673	0.673	0.673	0.673	0.598
Length of Barrel	42.62	40.48	36.23	29.83	23.62	19.68	7.87	5.04
Total Weight	9.46	9.21	7.30	7.32	5.41	4.93	2.63	1.36
Total Length	75.63 [1]	73.90 [1]	51.50	63.23 [1]	38.90	34.96	13.86	8.43
War Cartridge: Charges/Lb.	43	43	57	86	86	86	86	226
War Cartridge: Weight	162	162	122	81	81	81	81	31
" " " less priming	147	147	106	66	66	66	66	25
Price, in Francs	35.33	35	33	32	24.4	24.17	18.27	12.74

[1] With bayonet, length 18.1, weight 0.66.

OTHER EUROPEAN ARMS OF 1836

	England	Austria	Bavaria	Spain	Hesse	Holland	Frussia	Russia	Saxe	Sweden
Muskets										
Diameter of Ball	0.681	0.649	0.649	0.649	0.649	0.669	0.657	0.649	0.630	0.689
Weight of Ball	483	417	417	417	417	448	426	417	378	475
Caliber of Bore	0.760	0.709	0.709	0.709	0.709	0.728	0.736	0.709	0.689	0.728
Length of Barrel	42.13	44.09	42.52	43.70	44.49	43.30	42.52	40.94	41.73	44.49
Length of Bayonet	13.78	19.90	14.56	14.56	14.96	14.17	16.17	15.75	14.17	17.72
Weight of Arm	10.65	9.70	7.92	8.99	9.80	10.10	10.14	12.67	10.91	10.85
Musketoons										
Caliber of Bore	0.669 [1]	0.689	0.709	0.689	0.689	0.709	0.736	0.709	0.649 [3]	0.728
Length of Barrel	15.75	38.19 [2]	18.50	34.45	30.31	30.31	16.92	25.98	30.71	31.10
Weight of Arm	4.38	7.35	5.11	5.96	7.09	7.27	5.88	7.74	7.48	7.74
Pistols										
Caliber of Bore	0.669	0.649	0.689	0.709	0.689	0.709	0.689	0.709	0.669	....
Length of Barrel	9.05	11.02	10.43	9.05	11.22	9.45	11.42	10.63	9.05	....
Weight of Arm	2.22	2.42	2.50	2.44	2.81	2.63	2.83	3.01	2.22	....

[1] English ball for musketoon and pistol: Caliber .598, weight 342.
[2] There is another light cavalry Austrian musketoon: Barrel 33.46, weight, 6.28.
[3] There is another Saxe musketoon: Same weight, caliber .689, length 39.05.

Carbine: same ammunition as musket.

Model 1851 rifled musket, caliber .702, with 39-inch barrel: Minié ball of 696 grains and 0.690 diameter, 2½ drams FG powder, cartridge reversed in loading. Sights to 1,000 yards.

Model 1853 Enfield rifled musket, caliber .577, with 39-inch barrel: Pritchett ball of 530 grains (without cup), diameter 0.567, 2½ drams FG powder.

Artillery carbine, Model 1853: Same, except 2 drams FG powder.

Rifled Model 1842 (for Navy): Minié ball of 848 grains and 3 drams FG powder.

Several of the cartridges mentioned are shown on plate 34. Figure b is the cartridge for the caliber 0.702, M1835 musket, as altered in 1851. Figure d is the round for the sea service musket, M1842, and i, j, and k show Enfield M1853 rounds. Captain Hawes, writing on ammunition in 1859,[51] described the method of using these cartridges. In loading those cartridges in which the bullets were reversed, the soldier tore open the powder end, poured the powder down the barrel, then inserted the ball base downward, still encased in the paper. When it was in the barrel a distance equal to its length, he broke off the protruding remnants of the cartridge paper and rammed the bullet on down. Note that in the blank cartridge part of the powder was encased in a separate piece of paper to simulate a bullet. With this the soldier went through the same motions in loading as he would have with ball ammunition.

An official English publication of 1860 [52] tabulated their service loads as follows:

TABLE 5.—BRITISH SMALL-ARM CARTRIDGES, 1860

NATURE OF CARTRIDGE	Charge	Number of Bullets to a Pound	Diameter of Bullet	Diameter of Former	Number of Cartridges (ten in a Bundle) packed in Barrels, Cases, &c.									REMARKS
					¼ Barrel		½ Barrel		Box		Sea Service			
					Cartridges	Caps	Cartridges	Caps	Cartridges	Caps	Copper-lined Cases half	Dell's Cases, Sectional	Quarter Hexagon	
	Drams		Inches	Inches										
Blank for all arms	3½	...	...	.65	...	...	1,800	1,980	...	...	....	....	Quarter Hexagons are only packed with fractions, but will hold about 500	
Rifle Musket (1842) Sea Service	3	8½	.746	.65	500	625	....	....	...	...	1,300	1,300		
Ditto (1851) Ditto	2½	10	.691	.6	500	625	....	....	500	625	....	....		
Ditto (1853) Ditto	2½	13½	.568	.5	700	875	....	....	560	700	....	....		
Artillery Rifle Carbine	2	13½	.568	.5	800	1,000	....	....	560	700	....	....		
Lancaster's Rifle	2½	10	.28	.65	500	625	....	....	...	...	....	....		
Rifle Musket (1853) New Diameter	2½	13½	.55	.472	700	875	....	....	700	875	....	....		
Carbine (Carbine bore)	2½	20	.610	.59	700	875	....	....	...	...	....	....		
Carbine (Musket bore)	3½	14½	.680	.65	600	750	....	....	...	...	....	....		
Carbine (Victoria M.B.)	2½	14½	.680	.65	700	875	....	....	...	...	....	....		
Carbine (Paget's Rifle)	1¾	10	.674	.59	700	875	....	....	...	...	....	....		
Musket, Common	4½	14½	.680	.65	500	625	....	....	500	625	1,400	1,400		
Musket, Ordnance	3½	14½	.680	.65	600	750	....	....	...	...	....	....		

NOTE 1.—Caps are not packed in copper-lined cases, or in Dell's sectional cases, but are sent separately, in stone jars containing 1,000 each (Sea Service).

NOTE 2.—Wood Formers are made of boxwood, of a uniform length of six inches, with a hole pierced through, and one end concave, *except* for those for blank and Sharp's breech-loading cartridge, which are convex.

SMALL-ARM CARTRIDGES

Nature of Cartridge	Charge	Number of Bullets to a Pound	Diameter of Bullet	Number of Cartridges (ten in a Bundle) packed in Barrels, Cases, &c. — ¼ Barrel: Cartridges	¼ Barrel: Caps	Sea Service: Dell's Sectional	Remarks
Pistol (Musket bore)[1]...	2½	14½	.680	700	875	....	Balls lined with a fustian patch for Coast-Guard Service
Pistol (Carbine bore)[1]...	2	20	.610	800	1,000	....	
Pistol (Percussion)[2] ...	2	34	.511	...	....	2,400	

[1] The "formers" the same as Carbine M.B. and C.B.
[2] The "former" .5 of an inch in diameter.

In Europe between 1830 and 1860 small arms and ammunition development was intensive. The distinctive feature of many of the cartridges was the bullet used. In 1860 Busk[53] identified most of those which had extensive use, as well as a few novel types. (See fig. 18.)

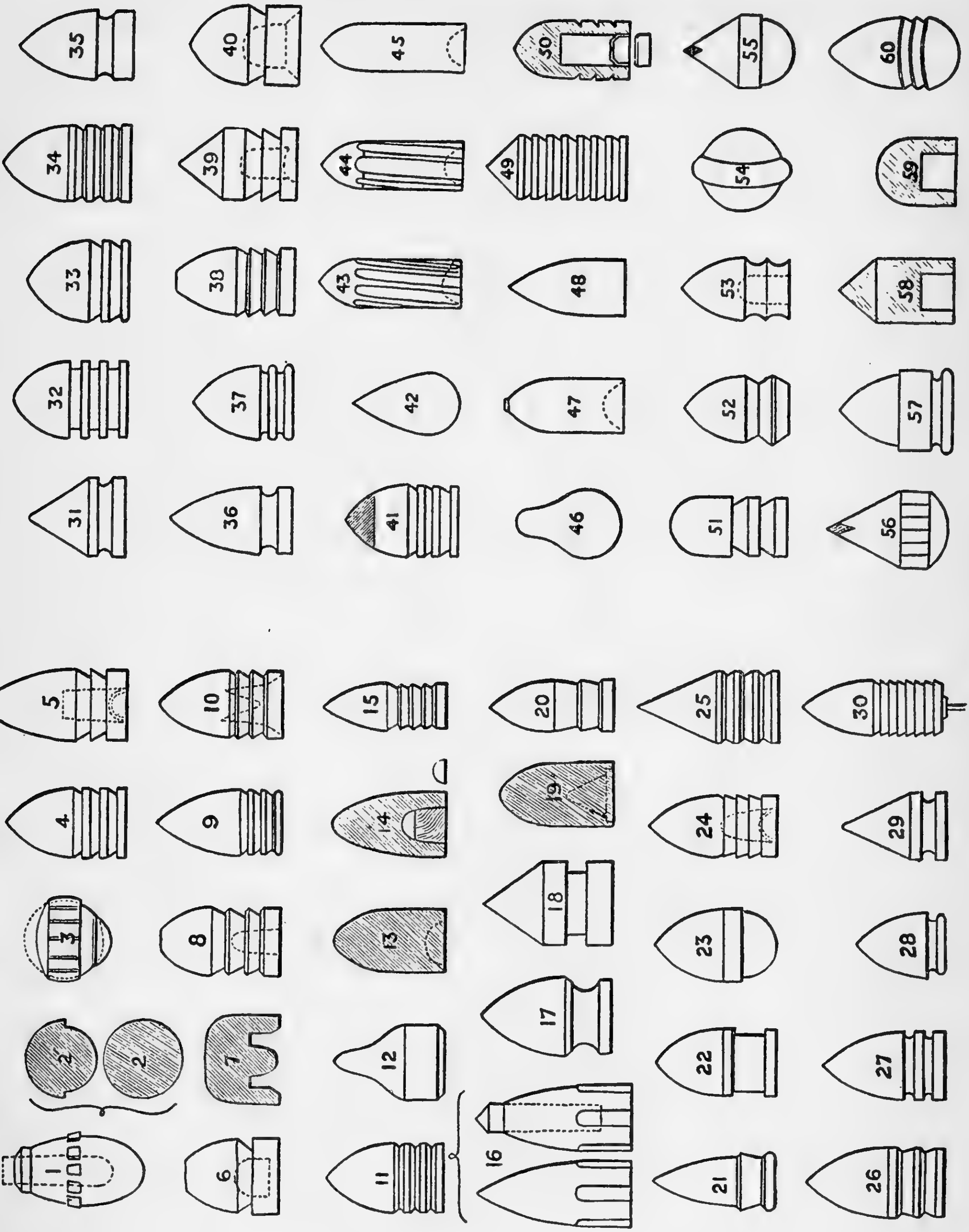


FIG. 18.—Bullets used in Europe, 1850-1860. (Busk.) See opposite page for explanation.

1. Captain Norton's original elongated percussion rifle shell, fitted with wooden plug.
2. Section of an ordinary spherical ball.
2'. Section of the same, compressed, in the barrel, on Delvigne's system.
3. Section of the same, compressed on Ponchara's system.
4. Bullets used by the Chasseurs de Vincennes and Zouaves.
5. Original Minié bullet, with iron cup.
6. Bullet originally used by the French Imperial Guard.
7. Bullet invented by Lieutenant Nessler (section).
8. Modification of the Minié.
9. Bullet used by Belgian riflemen.
10. Bullet used by Belgian infantry.
11. Bullet (last) adopted by the Sardinians.
12. Bullet (last) adopted by the Bersaglieri.
13. Pritchett Enfield (section).
14. Regulation Enfield, with boxwood plug (section) (the cup formerly used, is shown at the side).
15. Bullet originally introduced for Prince's breechloader.
16. Jacob's bullet and shell.
17. Bullet for the Russian *tige* rifle.
18. Austrian bullet.
19. Boucher's disc bullet (section).
20. Swiss Federal bullet.
21. Swiss Wurstemberger bullet.
22. Major Nuthall's bullet.
23. Bullet used with the Prussian needle gun.
24. Prussian modification of Minié, with iron cup.
25. Prussian bullet for Thouvenin's *tige* rifle.
26. Prussian bullet for Delvigne's rifle.
27. Saxon bullet (No. 1).
28. Saxon bullet (No. 2).
29. Saxon bullet for *tige* rifle.
30. Spanish bullet (M. Riera's) containing the charge of powder as well as the explosive composition.
31. Hanoverian bullet.
32. Bavarian bullet.
33. Oldenburgh bullet.
34. Nassau bullet.
35. Bullet for Norwegian breechloader.
36. French modification of Minié, without cup.
37. Bullet for Mecklenburgh *tige* rifle.
38. Spanish modification of the Minié.
39. Neapolitan modification of the Minié.
40. Bullet used by the French Imperial Guard (modification of No. 6).
41. Steel-pointed bullet used by the Chasseurs de Vincennes.
42. American "picket."
43. Bullet for Westley Richards' octagonal breechloader.
44. Whitworth's hexagonal bullet.
45. Whitworth's cylindrical bullet.
46. Bullet formerly used by the Bersaglieri.
47. Lancaster bullet.
48. American.
49. Bullet invented by Captain Tamissier, of the French Artillery.
50. Baden modification of the Minié, with tinned iron cup.
51. Wilkinson's bullet.
52. Danish.
53. Delvigne's improved bullet.
54. Belted Brunswick bullet.
55. Captain Tamissier's steel pointed bullet.
56. The same, after having been compressed into the grooves of the rifle.
57. Bullet recently adopted in Saxony.
58. Delvigne's original bullet.
59. Captain Thierry's bullet.
60. Captain Mangeot's bullet.

The United States Army at one time considered using the Nessler bullet (item 7) in the caliber 0.69 rifled musket. It was just as accurate as the heavy conical ball then in use (pl. 26e) and gave much less recoil.

In 1859 Wilcox [54] published a book on rifles which included illustrations of many different types of bullets then in use (see pl. 51). His tabulation of the characteristics of many of these bullets follows:

	Balls: Solid	Balls: Hollow, No Wedge	Balls: Hollow, Wedge	Powder ch'ge	No. of grooves	Twist of gr'ves		Species of rifles
	grains	grains	grains	grains		ft.	in.	
Austria	Lorens 450	...	...	61	4	5	2	Tige carbine and rifle-musket
Baden	...	...	590	69	5	4	4	Rifle-musket
Bavaria	675	...	...	66	4	5	..	Tige carbine
Belgium	756.5	...	...	62	4	6	6	Tige carbine
"	...	Peeters 725.5	...	85	4	6	6	Rifle-musket
Dessau	Lorens 463	...	...	77	4	5	..	Same as Austria
England	...	...	520	68	3	6	6	Enfield rifle
France	733.4	...	...	69	4	6	6	Tige carbine
"	...	494	...	77	4	6	6	Rifle-musket
Hanover	418	...	...	74	7	3	7	Tige carbine
Hesse Duchy..	...	...	625	69	5	6	2	Rifle-musket
Hesse Electoral ...		Peeters 608	...	..	4	6	2	Rifle-musket with chamber
Holland	494	...	...	61	8	3	2	Tige carbine, rifle-musket adopted 1853
Mecklenburg ..	442	...	...	56	..	..	..	Tige carbine
Nassau	722	...	...	69	5	4	4	Tige carbine
"	...	Ball hollow	...	..	..	..	..	Carbine without tige, and hollow ball since 1853
Norway	772	...	...	..	..	..	..	Carbine with tige and chamber
Oldenburg	421	Ball hollow	...	47	2, 4	6	8	Tige carbine and the two-grooved rifle
Prussia	490	...	...	50	8	3	1	Tige carbine with tronconic chamber
"	451	...	...	65	4	3	6	Needle breech-loader
"	...	705	...	79	5	4	6	Rifle-musket
Russia	772	...	...	71	2	..	..	Two-grooved rifle
"	705	...	...	..	..	..	..	Tige carbine
"	...	Ball hollow	...	..	..	..	..	Rifle-musket
Sardinia	530	...	...	54	8	1	5	Chambered rifle, Bersaglieri

"	700	...	...	63	4	5	..	Rifle-musket with tige
Sweden	402	...	...	77	6 8	3	4	Tige carbine with chamber
"	...	Peeters Ball hollow	...	..	6	6	6	Rifle-musket
Switzerland ...	257	...	...	62	8	3		Federal rifle
					4	2	3	Chasseur rifle
Spain	...	Peeters 447	...	69	4	4	10	Rifle-musket
United States..	...	500	...	60	3	6	..	Rifle-musket and rifle
Wurtemberg ..	...	...	...	92	12	2	10	Carbine system Wild

The caliber of 18-to-the-pound was generally used on the continent of Europe before the adoption of the rifle system.

Russia.—Russia's musket caliber was 18-to-the-pound, and the usual ammunition for the smooth-bore musket was the round ball, but in the 1850's much use was made of the Belgian projectile known as the "Nessler" ball. This was of cylindrospherical form, the cylinder being very short. The ball was hollow at the base to make it expand and had a projecting point in the bottom of the cavity. Its weight was 464 grains. Use of this ball in the smooth-bore musket was said to give an effective range of 300 to 400 yards—at least double that of the spherical ball. The cartridges for both types were made in the usual way, and the ball was dipped in melted tallow. The ball was inserted in the musket with the paper in which it was wrapped.

Many of their percussion muskets were rifled by cutting in them four wide grooves, as in the United States arms. The ball used for these altered arms was of cylindroconical form, also on the Belgian system, and with three grooves on the cylindrical part. Its weight was 755 grains. A similar ball was tried at Harpers Ferry Armory but was not adopted.

Several other rifles were also used, patterned after those of other countries. One was like the British Brunswick rifle, except that its bullet of 787 grains was ogival, having two projections to fit into the grooves, instead of the belted round ball used with unsatisfactory results in England. Experience in the Crimea indicated the effectiveness of these heavy rifle balls at very great ranges—there was one record of a man being killed at 1,500 yards from the nearest Russian lines by a rifle ball.[55]

Percussion caps used by the Russians were of the same size as those used in the United States and in nearly all European countries. They were manufactured near St. Petersburg with Belgian-made machinery.

Prussia.—Altered flintlock and percussion muskets in Prussia were the same caliber as those of the United States (0.69) and used cartridges made in a similar manner. The rifle was constructed on the "tige" system and was sighted to 700 paces (600 yards).

Austria.—Smooth-bore caliber 0.70 muskets were altered to percussion with a special tube-primer (pl. 46p). Noncommissioned Austrian officers and certain men of each unit had rifles of musket caliber (0.70) made on the Delvigne principle.

In the 1850's new muskets and rifles were adopted, both of caliber 0.55. In these the cone and cap were substituted for the tube-lock (Consol) system. Muskets were fitted with two kinds of rear sights—250 yards and 1000 paces (800 yards). The latter were for sharpshooters and NCOs.

The rifle was also made in two types; that for sharpshooters and NCOs had a "tige" in the breechpin and was sighted to 1,200 paces (1,000 yards). The other type had no tige.

The same projectile was used for all these arms. It was the "Wilkinson" ball, tried by the British at Enfield in 1852. Cylindro-ogival with two deep grooves in the cylindrical part and no base cavity, it weighed 450 grains. The powder charge was 62 grains and the cartridge was the same for rifle or musket. The powder case was of thin cardboard with a covering of thin cartridge paper, folded over one end of the case. The point of the ball was inserted in the open end of the cylinder and the whole again enveloped in thin paper. The part around the ball was greased and was inserted with the ball in loading. The altered musket of the former caliber (0.70) used a ball of the same design, weighing 680 grains, with a charge of 55 grains.[56]

France.—In the 1850's most of the French percussion muskets (new or altered from flintlock) were reamed out to caliber 0.708, carrying a 1-ounce round ball. It later became difficult to rifle these arms for the new elongated balls generally adopted. This was done, in some instances, by adding a tige to the breechpin and cutting four wide and shallow grooves in the barrel; such guns were sighted up to 800 meters. The balls weighed 720 grains and the powder charge 70 grains. The musketoon *a tige* used 46 grains of powder.

The Imperial Guard used a rifled musket, but without tige. This arm employed a cylindroconical ball with a cavity at the base, but without an expanding cup. The Minié ball as used in the late 1850's had two grooves in the cylindrical part and an iron cup in the base. It weighed 604 grains and was loaded covered with the greased cartridge paper.[57]

England.—In the 20 years prior to the Civil War in America, the system of small arms for the British Army was greatly changed. In 1840 the only rifled arms in use were the "Brunswick" rifles, which

fired a round belted ball.[58] A rifle-musket was adopted in 1851, retaining the old 0.702 caliber. The ball, on the Minié principle, weighed 680 grains; it had an iron cup in the base but no expanding wedge. In 1852 extensive trials were held in order to find a lighter arm. As a result the Enfield musket was adopted for general use. The bore was 0.577 inch, with three grooves, and the powder charge was 68 grains, the same as its predecessor, but the ball weighed only 530 grains. A similar rifle was adopted, differing but little from the musket and using identical ammunition. A carbine used 55 grains of powder and a "Sapper's" carbine was developed on the Lancaster system, with elliptical bore. Colt's and Deane and Adam's revolvers were purchased extensively for the cavalry.[59]

Belgium.—In the 1850's the rifled arms used in the Belgian Army were the rifled musket, with the Minié or the Timmerhans ball, and the *carabine a tige,* both similar to French arms of that period. The Timmerhans ball was cylindro-ogival and grooved, with a bell-shaped cavity in the base into which a point projected from the bottom of the cavity.[60]

The Mordecai Report on the Commission to Europe[61] included a tabulation of the principle arms and ammunition in use on the Continent, in England, and in the United States. As it contains much information on these arms, the table is reproduced herewith:

The Mordecai Report included drawings of many of the military cartridges of the 1850's. These were assembled in convenient form by Wilcox[62] and are reproduced on plate 52. They give a good idea of the variation in small-arms ammunition as to shape of ball and method of forming the cartridge.

Figures 1 to 7 represent cartridges in which ball and powder were in direct contact. The type shown in figure 8 maintained physical separation within the case by a sabot between ball and powder. Figures 9 to 11 show powder and ball separated by tying between. The remainder illustrated had separate cases for the powder within the outer wrapper.

Figure 1 represents the cartridge for the Belgian tige carbine. In this the paper was rolled around the ball and tied around the bottom groove of the bullet. The case was closed by twisting the paper. Figure 2 is the Hanover cartridge, much like the last, except the case was closed by a double fold. Figures 3 and 4 are for the tige rifle-muskets of Mecklenburg and Oldenburg. In these the case was made around a cone-shaped former. The small end was glued shut, the case filled with powder, and the ball inserted and tied. This am-

TABLE 6.—RIFLED SMALL ARMS USED IN THE ARMIES OF DIFFERENT COUNTRIES, 1850

DESIGNATION OF ARM	Caliber	Length of barrel	GROOVES Number	GROOVES Width	GROOVES Depth Breech	GROOVES Depth Muzzle	Twist	TIGE Diameter	TIGE Length	WEIGHT Without bayonet	WEIGHT With bayonet
	Inches	Inches		Inches	Inches	Inches	Inches	Inches	Inches	Pounds	Pounds
RUSSIA											
Brunswick rifle	0.69	31.5	2	0.31	0.032	0.032	31.5	....	...	9.7	11.35
PRUSSIA											
Needle gun	0.62	36	4	0.23	0.03	0.03	29	....	...	10.75	.....
Rifle à tige	0.577	27.6	8	0.11	0.025	0.025	36.8	0.27	1.7	10	.....
Wall piece	0.708	41	4	0.27	0.017	0.017	60	0.3	1.85	9.53	10.33
AUSTRIA											
Rifle-musket, (1854)	0.55	37.5	4	0.21	0.025	0.02	75	....	...	9.5	10.25
Do. (Jager)	0.55	28	4	0.21	0.025	0.02	75	....	...	9	10.5
Do. with tige	0.55	28	4	0.21	0.025	0.02	75	0.25	1.5	9	10.5
FRANCE											
Rifled musket à tige	0.708	42.64	4	0.27	0.02	0.004	78.75	0.35	1.5	9.34	10
Carabine à tige, (1846)	0.708	34.2	4	0.27	0.02	0.012	78.75	0.35	1.5	9	10.7
Do. des Cent Gardes	0.36	31.5	5	....	....	.....	31.5	....	...	7	....
GREAT BRITAIN											
Minié rifle musket, (1851)	0.702	39	4	0.25	0.02	0.01	78	....	...	9	10.5
Enfield rifle-musket, (1853)	0.577	39	3	0.262	0.014	0.004	78	....	...	8.7	9.2
Do. do. (1853)	0.577	34	3	0.262	0.014	0.004	78	....	...	....	....
Do. artillery carbine	0.577	24	3	0.262	0.014	0.004	78	....	...	6.5	8.25
SARDINIA											
Rifle	0.665	29.5	8	0.092	0.012	0.012	52.7	....	...	9.25	11.66
SAXONY											
Rifle, (musket, à tige)	0.577	40.4	4	0.20	0.025	0.025	64.5	0.3	1.7	....	.....
SWITZERLAND											
Rifle	0.414	32	8	0.08	0.015	0.015	36	....	...	9	9.51
NORWAY											
Breech-loading rifle	0.65	36.5	..	....	....	.....	58	....	...	....	.....
UNITED STATES											
Rifle-musket, (1856)	0.58	40	3	....	0.015	0.005	72	....	...	9.18	9.9
Rifle, (altered)	0.58	33	3	....	0.015	0.005	72	....	...	9.68	11.68
Pistol-carbine	0.58	12	3	....	0.008	0.005	48	....	...	5*	.....
Rifled musket, (altered)	0.69	42	3	....	0.015	0.005	72	....	...	9.34	10.10

* Detached stock included.

TABLE 7.—RIFLED SMALL ARMS AND AMMUNITION USED IN THE ARMIES OF DIFFERENT COUNTRIES, 1850

DESIGNATION OF ARM	BALL: Kind	BALL: Diameter	BALL: Length	BALL: Weight	CHARGE OF POWDER: Kind	CHARGE OF POWDER: Weight	Highest sight mark	REMARKS
		Inches	Inches	Grains		Grains	Yards	
RUSSIA								
Brunswick rifle	Ogival, with two guides	0.685	1.18	787	.....	..	.....	English two-grooved rifle, with sword-bayonet.
PRUSSIA								
Needle gun	Sphero-conical	0.63	1	440	Musket grain	56	.....	Priming attached to cartridge.
Rifle à tige	Cylindro-conical, with two grooves	0.56	1.03	366	Do.	56	580	Patent breech, with conical chamber.
Wall piece	Cylindro-conical, with three grooves	0.68	1.24	483	Do.	100	500	Do. do.
AUSTRIA								
Rifle-musket, (1854)	Cylindro-ogival, with two deep grooves	5.45	1	450	Large musket grain	62	800	Wilkinson's ball.
Do. (Jager)	Do. do.	5.45	1	450	Do.	62	800	Do.
Do. with tige	Do. do.	5.45	1	450	Do.	62	1,000	Do.
FRANCE								
Rifled musket à tige	Solid, cylindro-ogival, with three groves	0.695	1.12	720	Musket	70	875	
Carabine à tige, (1846)	Do. do.	0.695	1.12	720	Do.	70	1,300	Sword-bayonet.
Do. des Cent Gardes	Cylindro-ogival, solid	.....	....	180	Do.	30	.....	Sword-bayonet; breech loading; priming attached to the cartridge.
GREAT BRITAIN								
Minié musket, (1851)	Conoidal, with expanding cup	0.69	1.03	680	Do.	68	1,000	
Enfield rifle-musket, (1853)	Conoidal, with expanding plug	0.568	0.96	525	Do.	68	800	
Do. do. (1855)	Do. do.	0.568	0.96	525	Do.	68	800	
Do. artillery carbine	Do. do.	0.568	0.96	525	Do.	55	300	Sword-bayonet.
SARDINIA								
Rifle	Cylindro-conical, without grooves	0.64	0.93	540	Rifle	53	.....	Sword-bayonet; cylindrical chamber 0.44 inch in diameter, and 1.85 inch deep.
SAXONY								
Rifle, (musket à tige)	Cylindro-conical, with one deep groove	0.57	1	418	Rifle	85	.....	Same ball used in rifles without the tige.
SWITZERLAND								
Rifle	Cylindro-ogival, solid, with two grooves	0.41	0.94	240	Musket	62	800	Cylindrical chamber, of same diameter as the bore.
NORWAY								
Breech-loading rifle	Do. do.	.....	....	...	.....	..	.....	
UNITED STATES								
Rifle-musket, (1856)	Cylindro-ogival, three grooves, cavity in base	0.5775	1.025	510	Musket	60	1,000	
Rifle, (altered)	Cylindro-ogival, three grooves, cavity in base	0.5775	1.025	510	Do.	60	1,000	Sword-bayonet.
Pistol-carbine	Cylindro-ogival, three grooves, cavity in base	0.5775	1.025	450	Do.	40	400	
Rifled musket, (altered)		0.685	1.05	740	Do.	70	900	

munition was loaded intact and broken by ramming against the tige in the chamber. Figure 5 is a Saxony cartridge. Figures 6 and 7 are rounds for the Norwegian and the Swedish breech-loading muskets. The cartridge for the Prussian breech-loading needlegun is shown by figure 8. Figures 9 and 10 are for Bavarian arms and figure 11 is the cartridge for the Austrian Consol carbine. This round usually had the cap or percussion tube attached to it by a wire or string. Figures 12 and 13 are for the French tige carbine and the rifled musket. The British Enfield cartridge is shown in figure 14 and another type in figure 24. In the last, powder and ball were enclosed in small paper bags made from pulp in the proper sizes. Figures 15 to 19 are cartridges for Austrian, Baden, Belgian, Dessau, and Nassau muskets respectively. Figure 20 is for the Russian tige carbine, and 21 is for the Sardinian carbine. Figure 22 represents the cartridge used by the Swiss chasseurs. Figure 23 is for the Prussian rifle-musket. It had a row of perforations in the paper to facilitate breaking off in loading. One of the few double-ball loads used in Europe was the Danish cartridge shown in figure 25. Figure 31 is a United States specimen.

During the course of the Civil War both sides in the struggle purchased just about any serviceable foreign arms they could get. Naturally the ammunition supply problem must have reached an all-time high in our Service. A few of the commoner foreign cartridges used in the United States in the 1860's are shown on plates 33 to 35. Plate 32g–m shows the round used for the Whitworth sharpshooter's rifle used in the South with outstanding success. Cylindrical and hexagonal bullets were used interchangeably in the hexagon barrel. Both types are shown. The cartridge case is a tube of quite stiff cardboard. Plate 35a, j, h, f, shows cartridges for the French, Belgian, and calibers 0.70 and 0.71 Austrian arms—the French specimen was for a smooth-bore gun. These large foreign rifle-musket cartridges are quite distinct from the American ammunition of that size, in that they are made in the old or commoner manner. Our caliber 0.69 rounds for rifles were almost all made like the example shown on plate 26a, with the inner cardboard cylinder for the powder.

In differentiating between nearly similar rounds of paper ammunition it is comparatively simple to obtain approximate ball diameter without opening a cartridge. The majority of specimens have a total thickness of paper of 0.010 to 0.011 inch. By measuring outside diameter with a micrometer and subtracting an arbitrary ten thousandths, very close to the actual ball diameter will be obtained. One

can be quite positive in distinguishing the caliber 0.64 from the 0.65 balls, which will serve to date the United States cartridge to some extent.

The less handling of these old specimens the better. Unrolling the brittle paper to obtain detailed information will likely ruin the cartridge. Slight steaming first helps to avoid this damage. Large capsules of the sort used by veterinary surgeons or the plastic tubes now used for prescriptions by pharmacists are quite convenient for use as containers. The cartridges may then be handled and examined without much chance for damage. An ideal container can be tailored to fit using thin sheet plastic to form a box.

Supply and issue.—In the early publications of the United States Army, there were few instructions governing supply and issue of ammunition. The regulations published in 1814 (Appendix 8) prescribed that each company should make a return to the quartermaster of the number of cartridges deficient, the supply to be replenished with as little lost time as possible. Thirty rounds per man were to accompany the troops in the ammunition wagons, and a reserve of one-fourth this number was allotted to each infantry unit. Noncommissioned officers were instructed to examine cartridge boxes before putting them away, to assure that no ammunition had been left in them. Each brigade was to have an ammunition wagon containing 20,000 cartridges, for issue only on orders of the brigade commander. The officer in charge of the brigade ammunition wagon was authorized to replenish his supply either by requisition on the field commissary or by use of detailed personnel to make up ammunition from the necessary materials.

Army regulations of 1821 provided that cartridges were to be made in the field by the troops for their own use. The regulations of 1825 said, "Service ammunition, issued to troops, will be charged against them, and, to prevent waste or injury, the boxes will be inspected twice a day, and particularly at evening roll-call, when the number and condition of the cartridges will be ascertained, and if necessary (near an enemy) others supplied. Each man will be made to pay for the rounds expended without orders or not in the way of duty, or which may be damaged by his neglect. Ammunition will be frequently sunned."

The passage just quoted illustrates very well the manner in which the Army swings from wartime abundance to peacetime scarcity. After the War of 1812 there were enormous (for those days) stocks of ammunition on hand. For years thereafter it was next to impos-

sible to get any money out of Congress for purchasing new ammunition. The old stocks were retained as reserve and for current consumption till they were obsolete and greatly deteriorated.

On January 1, 1818, the Army had on hand over 8,000,000 small-arms cartridges, 253,000 pounds of lead, 1,750,000 flints, 416,000 pounds of sulfur, 380,000 pounds of saltpeter, and 1,174,000 pounds of gunpowder.[63] In 1826, an inventory of military stores in the immediate charge of the Ordnance Department was taken.[64] It showed the following items on hand.

10,504	barrels powder @ $20.00	$210,000
621,946	pounds nitre @ 9¢	55,975
397,444	pounds sulphur @ 3¢	11,923
6,549,000	musket cartridges @ 2¢	130,980
8,834,000	flints	26,500
107,450	cannoncartridges	20,490
	slow match	4,457
380	tons lead @ $120	45,600
63,183	rounds, scrapnel (sic), case and grape shot @ 70¢	43,528
13	tons loose grape & cannister shot	29,500
		$579,033

From 1822 to 1837 it appears that no small-arms ammunition was procured. During the year ended September 30, 1838, 2,300,000 ball cartridges and 225,000 pounds of powder were made or purchased. The following year 100,000 pounds of powder and 800,000 ball cartridges were obtained. During the next several years the greatest annual procurement was 1,000,000, and the largest issue 930,000 ball cartridges.[65] When the Mexican War started purchases rose rapidly. In 1847 the Army bought 298,000 pounds of powder and over 13,000,000 small-arms cartridges, with some 3,000,000 percussion caps. (The predominant arm was still the flintlock.) Issued to the troops that year were 12,950,000 cartridges and over a million caps. In 1848 over 4,000,000 cartridges and 14,000,000 caps were purchased or manufactured. The year following, with the war ended, cartridge production dropped to some 120,000 but over 8,000,000 caps were procured. Then, except for new types being introduced and used in relatively small quantities, supply of ammunition again stagnated until the Civil War was imminent.

In the many thousands of volumes written on the Civil War information concerning ammunition supply is almost entirely lacking. Yet an outstanding job must have been done, study of which might well have profited us immensely in later years.

The principal types of cartridges purchased in the North, as listed in Ordnance publications,[66] were:

Type or Arm	Caliber	No. Purchased
Ballard carbine / Ballard rifle	.42, .54	3,527,450
Burnside carbine	.54	21,819,200
Remington carbine	.42	4,257,000
Merrill's carbine	.54	5,502,750
Henry carbine	.42 (.44)	4,610,400
Gallager carbine	.51	8,294,023
Cosmopolitan carbine	.50	6,300,000
Maynard carbine	.50	2,157,000
6 other carbines	.50, .52, .54, .57	3,072,176
Sharps' rifle	.52	16,306,508
Smith carbine	.50	13,861,500
Spencer rifle	.56, .52	58,238,924
Starr carbine	.54	6,860,000
Rifle	.58 (& .577)	46,409,514
Buck & Ball	.69	6,021,220
Round ball	.54, .69	2,735,180
Pistol	.54, .58	26,225,930

(Also cal. .36 and .44 revolver cartridges in large quantities)

Complicated though the small-arms ammunition situation appeared, it was simplified for purposes of supply by grouping the various weapons. This was done as follows, as to ammunition:

Class	Arm	Ammunition
1.	Rifles & Carbines	Breechloading—Special cartridges
2.	<u>Rifle, cal. .54</u>	U.S.
3.	<u>Rifle, cal. .58</u>	U.S.
4.	Rifle, cal. 577 & .58	Foreign—(use #3)
5.	<u>Rifle, cal. .69</u>	U.S.
6.	Rifle, cal. .69	Foreign—(use #5)
7.	Rifle, cal. .70	Foreign—special cartridge
8.	Rifle, cal. .71	Foreign—special cartridge
9.	<u>Musket, cal. .69</u>	(round ball), U.S.
10.	<u>Musket, cal. .69</u>	(Buck & ball), U.S.
11.	Musket, cal. .69, .70 & .71	Foreign—(use #9 and #10)
12.	Musket, cal. .72 to .79	Foreign—(use special cal. .73)

Thus about two-thirds of the arms could be supplied with five (underlined) principal types of ammunition. This was still pretty bad, as three additional types were needed for some 600,000 other arms of foreign origin, besides those for the breechloaders.

Really tremendous quantities of ammunition were requisitioned from day to day and the orders filled. Requests for supplies had to

be explicit to avoid confusion, as is shown in the case of one typical small telegraphic order:

Louisville, October 28, 1861.
Send me 600,000 Colt's rifle cartridges. GENERAL SHERMAN.

Colt's rifles used calibers 0.44, 0.56, and 0.58 cartridges. There is no record of what General Sherman received—perhaps the man who made the shipment knew what his troops were using.

A routine consignment of ammunition was apt to be quite varied in composition as a sample will illustrate:

100,000 Enfield cartridges, calibre .577—100,000 blank cartridges—3,000 friction primers—100,000 percussion caps—40,000 Mississippi rifle cartridges—400,000 elongated ball cartridges, calibre .69—40,000 Burnside cartridges—100,000 elongated ball cartridges, calibre .715.

The following correspondence serves to illustrate a typical problem. Early in 1861 New York State made arrangements to acquire British Enfield rifles for State troops. Soon ammunition supply became a matter for serious consideration, as indicated by the letter quoted. Ripley's comments indicated a lack of conception of the probable scope of the War. Soon after his letter was written, United States agents were scouring Europe for serviceable weapons.

GENERAL HEADQUARTERS, STATE NEW YORK
ADJUTANT GENERAL'S OFFICE
Albany, June 14, 1861

THE CHIEF OF THE ORDNANCE DEPARTMENT
Washington, D. C.:

SIR: I beg to inform you that the authorities of this State have ordered the purchase and manufacture of 20,000 Enfield rifles and muskets, some of which have been received from England, and with which one regiment of volunteers have already been armed. The issue of this arm will be made from time to time to the troops of this State, and as the supply of the proper kind of ammunition is important, I inquired of the commanding officer at Watervliet whether it could be fabricated by him, and he said it could not. I ought to say that the caliber of the arms already received is .57, and that 100,000 rounds have been furnished to the regiment having the arms; but to continue the preparation of this ammunition and send it forward to regiments in the field is what can hardly be expected from this State. I therefore respectfully ask whether the Ordnance Department will undertake to furnish this ammunition as it does in other cases. It is to be regretted that the caliber is .57, but that was the only arm that could be purchased ready made. Those to be fabricated will be .58, so that the ordinary ammunition can be used.

An *early reply by telegraph* is respectfully asked.

I am, sir, very respectfully, your obedient servant
J. MEREDITH READ, JR.
Adjutant-General

ORDNANCE OFFICE, WAR DEPARTMENT,
Washington, June 17, 1861.

HON. SIMON CAMERON,
Secretary of War:

SIR: Before answering the inclosed letter from Adjt. Gen. J. M. Read, of New York, I must submit it to you for instructions, with the following remarks: One of the greatest evils that can befall the military service is the introduction of arms of different kinds and calibers, requiring varieties of ammunition. It inevitably produces confusion and embarrassment, both in the use and the preparation of cartridges. All the troops called into the United States service can be furnished by the Government with good, strong, servicable arms, suitable for the ammunition which we have the means of preparing at our arsenals. None other should be allowed, and where the States can not furnish arms of the United States calibers, requisitions for as many of them as are necessary to arm troops mustered into Government service should be made on United States arsenals. It is very important, in my opinion, that the issue of fancy arms to United States troops should be prohibited, and that those now in the hands of such troops should be exchanged for others of the regular kind and caliber.

Respectfully, your obedient servant,
JAS. W. RIPLEY
Lieutenant-Colonel of Ordnance

HEADQUARTERS ARMY
Washington, June 17, 1861

The General-in-Chief approves the views of the colonel of ordnance within expressed.

E. D. TOWNSEND
Assistant Adjutant-General

Approved:
SIMON CAMERON
Secretary of War

Ignition.—For about the first 60 years of its existence the United States Army depended entirely upon flintlock ignition for firing its small arms. During an additional 25 years the flint system was used with reserve arms—almost to the date of adoption of breech-loading cartridge arms as the standard, in 1866.

Many of our flints were imported from Europe; in fact the largest part of all we ever purchased came from overseas. Some few were made in this country, though the flint-knapping industry never became well established here. On July 4, 1776, Congress passed a measure to provide flints for the Army,[67] which stated in part, "The Board of War is empowered to employ . . . persons . . . to manufacture flints for the Continent."

The last official description of Army flints was printed in the 1849 edition of the Ordnance Manual, as follows:

Flints.—The best flints are translucent, with a smooth surface, of a uniform light yellow or brown color, and slightly conchoidal fracture. They are generally obtained from England or France.

The parts of a flint are: the *edge* or *bevel,* the *back,* the *sides,* the *face,* slightly convex, and the *bed,* or lower face, slightly concave; in using the flint, the bevel is placed uppermost. There are three sizes for military service; *musket, rifle* and *pistol,* flints. A good musket flint will last for more than 50 fires. Flints are issued to the troops in the proportion of 1 flint to 20 rounds.

	Musket		Rifle		Pistol	
Dimensions	Minimum	Maximum	Minimum	Maximum	Minimum	Maximum
Whole length	1.20	1.50	0.97	1.20	0.93	1.10
Width	1.08	1.13	0.79	0.88	0.83	0.92
Thickness at the back	0.26	0.33	0.20	0.29	0.21	0.27
Length of the bevel	0.39	0.55	0.41	0.71	0.30	0.42

The rifle and the musketoon take the same flint. In the inspection of flints, first verify their dimensions with a gauge, giving the maximum and minimum dimensions; see that the bevel is free from spots and irregularities of surface, that the face and bed are nearly parallel, and have not too great a curvature.

Compared to the flints used in sporting weapons, those made for muskets and military pistols seem unduly large and clumsy. Some of the common sizes are shown on plate 44. Benton [68] made the statement that British (yellow) flints were good for 15 rounds, whereas American (black) flints could be used for as many as 60 shots.

In 1834 experiments were conducted in England to test the percussion principle. First 6,000 rounds were fired from a flintlock musket at the rate of 32 minutes 3 seconds per 100 rounds. There were, in all, 922 misfires, or one in every 6½ rounds. Then 6,000 rounds were fired under similar conditions in a percussion musket, at a rate of 30 minutes 24 seconds per 100 rounds. In that case there were but 36 misfires, or one in 166 rounds. On the basis of those tests the British changed to the percussion system. The change permitted reduction of the service charge for the musket from 6 to 4½ drams, 1½ having been allowed formerly for priming and waste.[69]

The Hall carbine, first United States Army percussion arm, adopted in 1834, used Shaw's caps. These were purchased from commercial sources exclusively until 1845, when Washington and Watervliet Arsenals set up machinery to make caps under the Shaw patents. Meanwhile, in 1842, the percussion system received the official blessing for all small arms, though some flintlocks continued to be made for a few years thereafter.

Mordecai [70] tested the relative efficiency of flint and percussion ignition. He found that the percussion system gave from 14 to 24 feet per second increased velocity over the flint type of ignition. To assure a fair test he had nipples placed in the breechplugs of flintlock arms, leaving the original flashhole open so that the same amount of pressure would escape thence in each case.

In 1845 the Maynard tapelock was used in converting flint muskets to percussion. The roll of tape primers came wrapped in paper, as shown on plate 44d; the tape is illustrated by k. During the Civil War Maynard primers were packed in round tin cans. Dr. Maynard's description of his primer was as follows: [71]

The detonating material of the 'Maynard Primer' is in the form of *little lozenges,* each about one-sixth of an inch wide and one-thirtieth of an inch thick. These lozenges are enclosed between two narrow strips of strong paper cemented together and rendered waterproof and incombustible. The single strip thus formed is a little less than one-fourth of an inch wide, is very stiff and firm, and contains four of these lozenges (each of which is a *charge*) in every inch of its length; the charges forming projections, of their own shape, on one side, having considerable and equal spaces between them; the other side of the strip being one flat and even surface.

One of these strips, containing fifty or more or less charges, is coiled up and placed in a magazine in the lock, and is *fed out* by the action of the lock, one charge at each time the hammer is raised. When the hammer descends it cuts off and fires the charge fed out upon the vent (or nipple, if one is used) of the gun, thus igniting the powder of the cartridge within the barrel.

The United States Army standardized the Maynard primer lock in 1855 and continued its use until about 1860. The Massachusetts Arms Co., of Chicopee Falls, Mass., had purchased the exclusive rights to apply the Maynard system of priming to sporting arms.

Other patented priming systems were tried by the Army; some of them were used extensively. The "Sharps' primes" or pellets, used on Sharps carbines and rifles, were little discs of copper containing the priming mixture. The mechanism threw one of these discs between the nipple and the hammer during the fall of the latter. A tube of these primers is shown on plate 44e. The first Sharps carbines equipped with this mechanism were of the model with slanting breechblock. (Some early Sharps arms had Maynard primer locks.) These first Sharps primers came in brass tubes packed in small tin boxes, as shown on plate 44h.

It was said [72] that this ignition plan worked very well when away from the action of the wind, but that if the wind were brisk the disc was blown away with consequent misfire.

Ward's patent primer was tried by the Army in 1856. This used a Maynard primer tape but carried the roll of primers in a special hammer. Some Gedney patent locks were tried also. In 1859, 5,000 converted muskets were equipped with Butterfield primers. The Butterfield system used a disc similar to the Sharps, but they were inserted from below rather than from above. Lawrence's primer, an improvement on the Sharps patent, was tried in 1857 and continued

in use on the Sharps arms for several years.[73] In this the detonating mixture was completely enclosed in copper. The Sharps type had foil on one side.

During the Civil War two general types of percussion caps were used, besides the tape and disc primers. The ordinary musket cap (pl. 44,o) came in cans of 100, 250, or 500. Packets of paper cartridges or other externally primed ammunition usually contained a roll of caps (pl. 44a, b, c). Revolver caps were the other, much smaller, type in use. (See pl. 44n.) They also came in bulk, in cans of 100, 250, or 500, and in paper packets (pl. 44f) as well.

Some difficulty was experienced because there were minor variations in nipple sizes in the various makes of revolvers. Several sizes and types of revolver caps were used commercially. This caused trouble in the Army, as indicated by the correspondence that follows:

New York Arsenal, July 5, 1862

Brig. Gen. J. W. Ripley,
Chief of the Ordnance Department, Washington City:

General: I have made some experiments with percussion caps and revolving pistols and have reached the following conclusions, viz:

First, a cap suitable for Colt's pistol does not suit either Savage's or Starr's, because the main spring is too weak to explode it.

Second, a cap suitable for Savage's or Starr's pistol does not suit Colt's, because the hammer drives it in pieces, a fragment often lodges in front of the cock, and renders the arm useless after the first fire. On this account our spies carry two pistols, and have had to depend on the second for safety for the reason above stated. Therefore, I am compelled to have two qualities made, one for Colt's answering in thickness of copper to Eley's double waterproof, and the other for Savage's and Starr's to Eley's metal lined.

I am, sir, very respectfully, your obedient servant,

R. H. K. Whiteley,
Major of Ordnance

Ordnance Office, War Department,
Washington, July 12, 1862

Maj. W. A. Thornton,
United States Arsenal, West Troy, N. Y.:

Sir: I inclose herewith a copy of a letter received from Major Whiteley on the subject of percussion caps for revolvers. The suggestions are of great importance, and you will please see that all revolvers made for this Department are suited to fire the same caps as Colt's army pistols.

Respectfully, etc.

Jas. W. Ripley,
Brigadier-General

Nearly all Civil War period locks were of the percussion class (except for self-contained ammunition, of course). Some flintlocks

were used for lack of more modern arms. A few Austrian arms were imported which used the Consol ignition system. This was a flintlock conversion in which an iron seat replaced the pan. A groove in this contained the primer, held in place by a cover corresponding to the lower part of the original flint battery. The percussion-type hammer struck the top of the cover, firing the primer. The priming itself was contained in a tiny copper tube, crimped at the ends. This tube had a copper wire attached to one end, by which it was handled (pl. 44p). Most of the Austrian muskets we purchased had been converted a second time, to the usual percussion system. These Austrian arms are occasionally mentioned in official correspondence as "Boker" muskets or rifles. H. Boker & Co. were the New York agents who handled the Austrian deals.

To understand how the early ammunition was made and used it is necessary to know something of the manufacturing processes involved. Originally a large proportion of the cartridges were made in the field; later full-time arsenals or private contractors did the work.

NOTES

(See Bibliography for full literature citations)

1. As recently as in 1942, Civil War ammunition was found at Benicia Arsenal, California.
2. Calver, William L., Consider the Revolutionary bullet.
3. Leg. Hist.
4. *Ibid.*
5. *Op. cit.*
6. Ord. Rep., Vol. I, Letter Mar. 12, 1813, Col. Decius Wadsworth to the Secretary of War.
7. Percussion load of 65 grains plus 8 grains of priming.
8. Duane.
9. Sen. Doc. 15, 25th Congress, 1st Session, 1837.
10. Ord. Records, National Archives.
11. Mordecai, 1845.
12. Small Arms, 1856.
13. Benton.
14. *Ibid.*
15. Ord. Rep., vol. 3, Letter, Sept. 20, 1864, from Maj. T. T. S. Laidley to Brig. Gen. A. B. Dyer, Chief of Ordnance.
16. Ord. Memo. No. 1.
17. House Doc. 72, 37th Congress, 2d Session.

17a. Thierbach, M., Die geschichtliche Entwickelung der Handfeuerwaffen.

18. Stonehenge, J. H. W. The shotgun and sporting rifle. Hereafter cited as Stonehenge.
19. Knight.
20. *Op. cit.*

21. Certain types of ammunition, likely to be mistaken for others of about the same proportions, were bundled in colored paper for positive identification.

22. Pamphlet, The William bullet, 1862; bound in "Pamphlets Descriptive of Inventions of Ordnance, etc.," Ord. Libr. Washington.

23. The parts of Williams bullets can be found in most collections of Civil War battlefield relics.

24. Reuben Shaler's patent, Aug. 12, 1862.

25. Ord. Rep., vol. 4, 2d indorsement of report from Captain Wright to Ordnance Office, referred to National Armory.

26. The sample Colt revolver, altered to use five 45/70 cartridges, was actually fired with no serious effects, despite legend to the contrary. It was intended to use the carbine cartridge, but was tried with that for the rifle to test its safety. During these tests, work was begun on a few pistols intended to be used for firing Captain Wright's "buckshot" loads in the 45/70 case. The project was discouraged officially, so these pistols were never finished and the parts were later sold as junk. They had smooth-bored barrels and were made from rifle parts, adapted to a pistol stock. These should not be confused with the M1868 pistol, which used the .50-45 cadet cartridge. Only a few were made; specimens may be seen in the Springfield Armory collection.

27. Greener, 1858.

28. *Op. cit.*

29. Ord. Rep., vol. 3, p. 1008.

30. Samuel Gardiner, Jr., patented Nov. 23, 1863.

31. Knight.

32. For additional details on explosive bullets see: Lewis, B. R., in Ordnance, May-June 1954.

33. Rowland, Dunbar, Jefferson Davis, constitutionalist, vol. 8, p. 413.

34. Grant, U. S., Personal memoirs, p. 538, New York, 1885.

35. Records of the Union and Confederate navies, ser. 2, vol. 1, p. 521.

36. *Ibid.,* p. 776.

37. *Ibid.,* vol. 16, p. 89.

38. David M. Mefford patent, January 28, 1862.

39. CSA; The field manual for the use of officers on Ordnance duty, Richmond, 1862.

40. CSA Ordnance Manual, Charleston, 1863.

41. Ord. Memo. No. 14, Washington, 1873.

42. Ord. Memo. No. 1, Washington, 1865.

43. Valentine, W. J., and Norton, Charles B., Report to the Government of the United States on the munitions of war exhibited at the Paris Universal Exhibition, 1867.

44. *Op. cit.*

45. Ord. Mem. No. 5, Washington, 1864.

46. Adye, R. W., The bombardier and pocket gunner.

47. *Op. cit.*

48. *Op. cit.*

49. *Op. cit.*

50. *Op. cit.*

51. Hawes, Arthur B., Rifle ammunition, etc.

52. British War Dept.; Treatise on ammunition, London, 1860.

53. *Op. cit.*

54. Wilcox, C. M., Rifles and rifle practice.
55. Mordecai, 1860.
56. Schön, T., Das gezogene Infanterie-Gewehr.
57. *Ibid.*
58. Senate Dec. 229, 26th Congress, 2d Session; Report of board of officers, 1841.
59. Busk.
60. Schön.
61. Mordecai, 1860.
62. *Op. cit.*
63. Ord. Rep. vol. 1.
64. *Ibid.*
65. *Ibid.*
66. Sum. St. Ord. Purch. 1866 (see Appendix V).
67. Leg. Hist.
68. *Op. cit.*
69. Blanch.
70. Mordecai, 1845.
71. The Maynard system of firearms, pamphlet, Washington, 1862.
72. Stonehenge.
73. Benton.

Chapter VI

AMMUNITION MANUFACTURE

In the early days of our Army, small-arms ammunition was for the most part made up by the troops themselves and issued simply as powder, cartridge paper, and lead. Often the components were loaded into the musket directly from the flask (or horn) and bullet pouch. This was particularly true in the case of riflemen. Committees of Safety purchased paper cartridges from time to time, but most fixed ammunition was made from Government materials by contract, on a piece-work basis. In Philadelphia during 1781 the Commissary-General of Ordnance paid contractors for musket cartridges at the rate of 5 cents apiece.[1]

The official arsenals and armories have traditionally been the centers of ammunition procurement. There were a number of them in 1788, when a report to Congress listed "depositories of Ordnance, arms, and ammunition of the United States: Providence, R. I.; Springfield, Mass.; Mohawk River; West Point on Hudson's River; Charleston, S. C.; New London and Manchester, Va.; and Philadelphia. Principal arsenals are: Springfield, West Point, and Philadelphia."[2] The Act of April 2, 1794, authorized "three or four arsenals, either or both Springfield and Carlisle to be counted at the discretion of the President." That year Springfield and Harpers Ferry Armories were designated as two of these.[3]

In 1812 Col. Decius Wadsworth (Commissary-General of Ordnance from July 2, 1812, to February 8, 1815) wrote the Secretary of War that "in the making of musket cartridges, children of 12 or 14 years of age can be employed as usefully or even more so than men. . . ."[4] Army regulations published in 1814 (see Appendix 8) provided for three laboratories or arsenals. "At these workshops shall be . . . prepared all kinds of ammunition for garrison and field service." Frankford Arsenal was authorized in 1816. By 1830 it had grown to be a large establishment, as indicated by a contemporary newspaper cut, figure 19.

Army regulations in 1831 provided that cartridges were to be made by the troops and in 1825 that "blank cartridges will be made up in paper of a colour different from that used for service ammunition."

During 1825 the St. Louis Arsenal was authorized to supply troops on the western frontier.[5] In 1836 another was set up at Fayetteville, N. C.[6] In the annual report of the Chief of Ordnance to the Secretary of War in 1841 Frankford Arsenal was mentioned as "well situated for supplying arms and ammunition to the country from the Chesapeake to the Delaware; the vicinity of the principal powder works in the United States [Du Pont] makes this arsenal the principal depot of gunpowder and of the materials for its manufacture." [7] Frankford Arsenal gained in importance and eventually became the center of Government ammunition development and manufacture.

United States' Arsenal, near Bridesburgh, Pa.

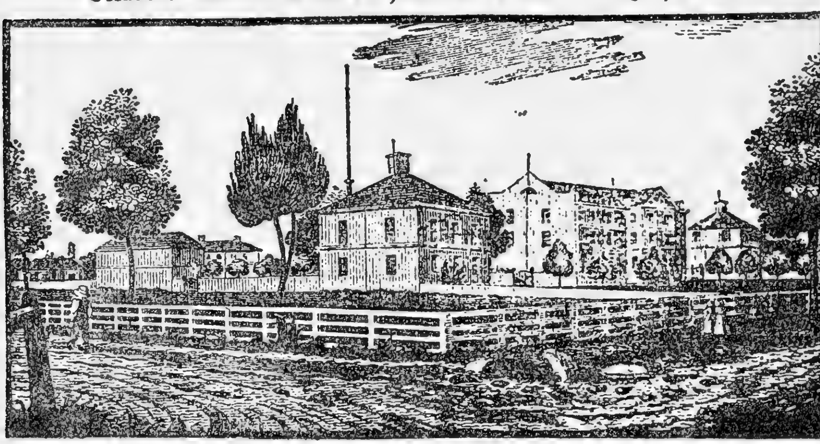


FIG. 19.—Frankford Arsenal in 1830. (Hutchinson: Saturday Evening Post.)

In 1845 machinery for making percussion caps under Shaw's patent was installed at Frankford and Watervliet Arsenals.[8] In 1846 machines were set up at Frankford for making lead balls by compression at the rate of 40,000 per 10-hour day. Similar machines were made for the St. Louis and Watervliet Arsenals.[9]

Several large commercial establishments made percussion caps. Part of the manufacturing process was described as follows:

The American Flask and Cap Company have machinery for filling percussion caps with fulminating powder and also an arrangement for counting caps that is somewhat peculiar. A little girl holds in her hand a perforated plate, which she thrusts in the heap of caps before her, each hole being just large enough to admit a single cap, and slight sifting motion causes the apertures to be filled. There are one hundred holes in the plate, and consequently when the plate is full the exact number is known. There is also a false bottom to the counter, which being pulled out allows the caps to fall into a long trough, from which

they are easily slid into paper boxes. About one hundred tons of copper are annually converted in Percussion Caps in this establishment.[10]

During the Civil War the Government plants could not meet the demands for ammunition. Many State arsenals were in operation, supplying both State and Federal troops. A typical example was the arsenal at Indianapolis, established April 27, 1861, by direction of the Governor of Indiana. This arsenal was to make ammunition for the regiments of the State, there being no cartridges on hand or obtainable. After getting into operation the arsenal made large shipments to United States troops. One order, shipped to Tennessee in May 1862, contained the following cartridges:

921,000	rifle, elongated ball, with caps, cal. .69
908,000	rifle, cal. .577
221,000	rifle, cal. .54
21,000	buck and ball, with caps, cal. .69
63,000	buck, no caps, cal. .69
52,000	Colt's rifle, with caps, cal. .54
159,000	Mississippi rifle, no caps, cal. .54
57,000	Colt's rifle, no caps, cal. .54
30,000	Sharpe's [sic] carbine
601,000	musket round balls, cal. .69

This shipment weighed 320,000 pounds and required 3,033 packing boxes.[11] It is plain that ammunition supply was no small matter.

Materials were a problem, even cartridge paper. Perhaps there were paper-gathering campaigns in those days, too. In 1862 Maj. Gen. Hindman wrote from Arkansas: "As illustrating the pitiable scarcity of material in the country, the fact may be stated that it was found necessary to use public documents of the State Library for cartridge paper." [12] This practice, born of necessity, had prevailed during the Revolutionary War as well. (See pl. 23a.)

In 1864 defects in paper cartridges were mentioned in a letter from the Chief of Ordnance to one of the arsenals: [13]

ORDNANCE OFFICE
War Department
Washington, D. C., April 6, 1864

SIR: I enclose herewith, for your information, official copies of two reports received at this office in relation to the defects in the small-arm ammunition furnished from the ———— Arsenal.

As this is a matter of the utmost importance, and a defect which has already brought discredit on the Department, you will be pleased to give the matter your early attention.

You will have a thorough inspection made of all ammunition on hand, and all lots in which the charge falls below the standard will, so far as in your judgment is practical, be broken up and made over.

An accurate report will be made to this office of the date of manufacture and kind of such unserviceable ammunition, and of the amount of each kind which you may find necessary to break up.

From and after the date of the reception of this circular the charge for the .574 or .58 calibre ball will be 65 grains, and every precaution will be taken to see that full weight is given, to secure which every cartridge must be carefully gauged or weighed before packing.

Hereafter, in order to insure greater care, persons employed in filling cartridges *will be paid by the day.*

Respectfully, your obedient servant,
Geo. D. Ramsay
Brig. General,
Chief of Ordnance

To the Commanding Officer
———— Arsenal.

Prior to 1864 the Army had purchased most of its special metallic or patented types of cartridges from commercial sources. In the cases of many of the carbines, bought in relatively small numbers for trial, the order for cartridges was included in that for the arms themselves. During the war it became desirable to start production of metallic cartridges at Frankford Arsenal.[14] Chief of Ordnance Ramsey outlined the plans in a letter to the Secretary of War:[15]

Manufacture of Copper Cartridge Cases.—Major Laidley, commanding Frankford Arsenal was directed October 3, 1863, to prepare plans and estimates for a rolling mill and buildings of sufficient capacity to manufacture 20,000,000 copper cases for the self-priming cartridges; 3,000,000 friction tubes or cannon primers, and 259,000,000 percussion caps per annum. These instructions were subsequently modified so as to increase the number of cartridge cases to 100,000,000, and the number of caps to 450,000,000. Major Laidley forwarded the revised plan and estimate May 21, 1864. The elevations have not as yet been fully decided upon. Major Laidley's capacity at present for manufacturing these articles is as follows:

Friction tubes, 2,500,000 per annum; percussion caps, 115,000,000 per annum; copper cases, expects in one week from date to manufacture 10,000 per day; in a month 25,000 per day, and, as soon thereafter as the necessary machinery can be procured, 100,000 per day, or 31,000,000 per annum, which will be the limit when the new shops are erected.

During the course of the war the United States purchased or made over 208,000,000 carbine cartridges, of which more than 75 percent were obtained from commercial sources. The Spencer type was the commonest in use, the number from all sources exceeding 58,000,000. It should be remembered, however, that this cartridge was the nearest approach to a "standard" item for carbines, used during the last year of the war in at least six different types of weapons. The Burnside cartridge was a poor second in quantity obtained, with some 21,-

000,000 rounds, followed by the Sharps, Smith, and others. (See Appendix 5.)

Prominent among the commercial cartridges used were several patented types. Some, such as the Poultney, were adaptable to several different arms, the patent covering only methods of manufacture. Others, such as the Maynard, were for a specific weapon.

Poultney's patent covered a method of manufacturing a cartridge case by rolling a sheet of brass foil upon a mandril with a sheet of paper. The base was then crimped over, leaving a small opening through which the flame from the percussion cap passed. This type cartridge was made for the Maynard, Smith, Gallager, and Burnside carbines.

The Maynard cartridge, used in Civil War carbines of that name, was one of many types patented by the dentist-inventor. It comprised a brass tube with a perforated brass disc soldered to the base end to form a case, which was loaded with powder and ball. These cases could be reloaded many times, if desired.

The Jackson patent cartridge resembled the Poultney superficially but was made from a tinned-iron tube covered with paper. Its only extensive use was in the Gallager carbine. The paper has a brownish color (shellac?) and a magnet gives a positive check.

The Smith cartridges were used only in the carbines and rifles of that name. The first type had a case made of rubber; later a Poultney cartridge was used in its place. Near the end of the war some of the Crispin copper cartridges were used in Smith carbines. These had priming compound in a center rim.

Several other patents were involved in the manufacture of the many different combustible or skin cartridges for revolvers. Most of these incorporated some method of compressing powder, then coating it with a waterproof substance. The Doremus and Budd patents (cartridges made by the Hazard Powder Co.) first involved a membrane wrapped spirally around a truncated cone of pressed powder. Later a coating of collodion was employed.

Under the Bartholow patent the powder was mixed with shellac and the final product coated with the same material. The bullet was attached by a strip of silk cloth.

The Johnston and Dow patent cartridge was made of combustible paper filled with powder and coated to protect it from moisture. The Hotchkiss type (used in the Sage ammunition) was not much different.

Hayes' patent (British) consisted of a cardboard tube in which a

combustible cartridge was placed. A tearing strip was provided to facilitate removal of the covering. These were made in the United States as the "Broux" cartridges, under Storm's patent.

Foil cartridges were made for Colt revolvers. In 1863 there was a separate Colt factory in Hartford for the manufacture of metallic foil ammunition, "a contrivance invented by Colonel Colt that always insures 'dry powder' to the possessor."[16]

Several of the types just enumerated were made for calibers larger than the revolvers: Colt's rifles, Sharps' carbine, calibers 0.54, 0.58, and 0.69 muskets, and so forth.

Some carbines and rifles used cartridges made with tubes of linen. Others used plain paper tubes, pasted together.

Most of the rimfire ammunition made during the war was based on the Smith and Wesson patent of April 17, 1860. Though some Spencer cartridges were made at Frankford Arsenal, the great bulk of these and other rimfire types were purchased from commercial sources. At that time the technique of drawing brass or copper cartridge cases was just being developed. Many of the cartridges made carried no head-stamp for identification; hence they are somewhat difficult to attribute to a definite manufacturer. Several of the leading producers did, however, mark some of their products. Among these were: Crittenden & Tibbals, South Coventry, Conn. (mark CT); Fitch & Van Vechten, New York City (mark FVV or FVV & Co.); Jacob Goldmark, New York City (mark JG or $\overline{\text{JG}}$); C. D. Leet, Springfield, Mass. (mark CDL); and Sage Ammunition Works (D. C. Sage Co., Sage & Company), Middletown, Conn. (mark SAW). (See pl. 42.) Other manufacturers such as the New Haven Arms Co., New Haven, Conn.; Sharps and Hankins, Philadelphia, Pa.; and Spencer Repeating Rifle Company, Boston, Mass., did not mark their ammunition, except on the package label.

As records of payments to groups of individuals indicate that cartridges were made during the Revolutionary and 1812 Wars under many small contracts, it follows that specifications for cartridge manufacture must have been issued. A copy of such instructions has not been found, but existing specimens of the ammunition indicate that the procedure differed from that used at a later date principally in the manner of closing the ends of the tube. Both French and British types were used, the ultimate type combining features of both.

It appears that in the French cartridge the tube was formed on a round stick of ball diameter; then one end, which protruded slightly, was pasted and folded over flat, afterward having the appearance of the common envelope fold. The straight longitudinal seam was also

pasted. The ball was then dropped in, the charge placed on top, and the tube pinched together above the powder. The open end was next bent at right angles close to the powder and the base of the cartridge was struck smartly on the table. Then the folded part was refolded lengthwise, about one-quarter the width from each side. Finally the resulting pigtail was bent back at right angles and left parallel to the cartridge.

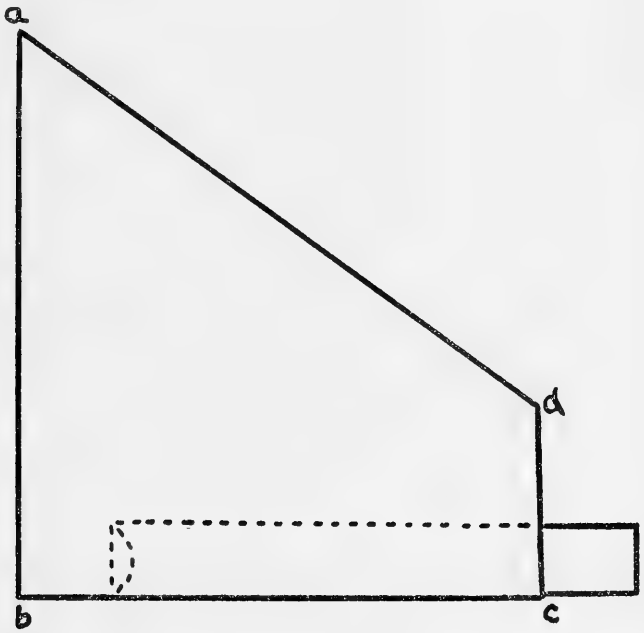


FIG. 20.—Cartridge paper, 1776.

The British style of cartridge had the ball end tied off and the other end simply twisted. The method of manufacture was stated in a pamphlet adopted as official by Massachusetts Bay in 1776.[16a] As this system was no doubt that followed during the Revolutionary War for making cartridges in the British manner, it is quoted, as follows:

VII, the best method of making cartridges seems to be that used in the Army. It is this: Take the soft brown paper called whitish brown, or wrapping paper, and cut it into pieces of the form represented in Plate 1 [fig. 20], which is of these dimensions; the side ab measures about six inches, bc about five and a half, and cd about two inches. A piece of wood about six inches long is to be made round so as to fit exactly the size of the ball; this is called a *former:* make one end of it hollow to receive a part of the ball: lay the former upon

the straight edge bc (as represented by the dotted lines) with its hollow end about an inch from the side ab; roll the paper around the former; then with the ball press in the corner of the paper so as to cover the hollow end of the former; and keeping fast the ball, roll on until the paper is all wrapped round the former; having before taken a piece of twine and fastened its two ends to something that cannot easily be moved, and so far apart as to leave it slack, you are now to take with the twine a single turn around the paper, below the ball; then running in the end of your fore finger till it touches the ball, pull upon the string that it may girt the paper, and by turning round the former with one hand you will presently form a neck below the ball; which being afterwards tied with a piece of coarse thread will secure the ball from slipping out; then withdrawing the former, the cartridge is ready to be charged with powder; in doing which you must put in the more because part of it is to be taken for priming: having properly filled the cartridge, twist the top, and the work is done. The size of the paper above described will serve for an ounce ball: if your ball be less, the paper may be somewhat smaller. One thing should be remembered, that if the cartridge exactly fits your firelock when the barrel is perfectly clean, it will be too large, and difficult to be rammed down, when it becomes foul by firing; and 'tis dangerous firing when the ball is not rammed well home; for this therefore you are to make allowance.

Sometime between 1816 and 1839 the method of making cartridges was changed. The former date was that of the manufacture of the most recent available specimen made in the old manner. The latter was the date of the earliest Ordnance manuscript describing cartridge manufacture in the more familiar way. It is likely that this change actually occurred about 1835, when better powders were responsible for bringing about a general study and revision of small-arms designs and loads.

Several grades of paper were used for cartridges. The 1839 (manuscript) Ordnance Manual [17] listed under "Ammunition and Materials for Ammunition" the following:

Laboratory Paper
- No. 1 (Musket Cartridge)
- No. 2 (Wrappers for do.)
- No. 3 (Blank Cartridge)
- No. 4 (Rocket and Port Fire)
- No. 5 (Field Ammunition)
- No. 6 (Cannon Cartridge)

The first published instructions for United States cartridge manufacture were in the Ordnance Manual of 1841. Except for the Hall carbine, the arms involved were all flintlock.

CARTRIDGES FOR SMALL ARMS

KIND	BALLS: Diameter	BALLS: Number in 1 pound	CHARGES OF POWDER: Weight	CHARGES OF POWDER: Number in 1 pound	CHARGES OF POWDER: Ratio to wgt. of ball	CHARGES OF POWDER: Blank cartridges	REMARKS
	In.		grains			grains	
Musket	0.64	18	130	54	1-3d	117	Musket powder
Musketoon	0.64	18	85	82	2-9ths	77	
Hall's carbine, musket calibre	0.64	18	75	93	1-5th	68	Rifle powder
Do. rifle calibre	0.525	32	75	93	1-3d	68	
Hall's rifle	0.525	32	100	70	4-9ths	90	
Common rifle	0.525	32	100	70		90	
Pistol	0.525	32	50	140	2-9ths	45	

These charges include priming, about 6 gr. to 12 gr., for all the arms except the carbine which has a percussion lock.

Buckshot are 0.3 in. in diameter; weight about 170 to 1 lb.

Cartridges are made either with *single ball,* 1 *ball and* 3 *buckshot,* or sometimes with 12 b*uckshot,* and they are designated accordingly.

Making Balls

6 Men required to each kettle; 2 to cast the balls, 1 to extract and roll, and 3 to trim them.

TOOLS AND UTENSILS. 1 *Iron kettle,* fixed in a furnace as before described—2 *iron ladles,* 0.10 in. thick, 3.5 in. diameter, with a lip on the left side and a handle 18 in. long a little bent—1 *bench,* of 4 in. plank—6 *moulds,* (brass,) with double rows for 6 or 8 balls on each side, or for 8 balls and 15 buckshot; placed on the bench—1 *mallet*—1 *double ball-gauge;* the diameter of one ring is 0.002 in. greater, that of the other 0.0015 less, than the true calibre of the ball—3 *nippers;* one arm is bent and fixed in the bench, the other is about 5 in. longer and has a wooden handle; the jaws are of steel, two inches wide, tempered and ground sharp; they may be so formed as to cut the gate according to the spherical surface of the ball. Under the jaws of the nippers is a hole in the bench, through which the balls fall into *boxes* placed to receive them—1 *rolling barrel,* 2 feet long and 1 foot diameter, made of hard thick staves, with but little bilge, and hooped with iron; it has a small scuttle in the bilge, with hinges and a hasp and staple; the barrel has a gudgeon in each head, and is turned by a crank in a frame to which a hopper may be attached. Instead of the rolling barrel, 2 strong *canvass bags* may be used; they should be 5 feet long and 16 in. in diameter, suspended horizontally by 4 cords attached to the joists of the building—1 *screen,* (sheet iron,) the holes of which are of the diameter of the largest calibre gauge; it is supported by gudgeons which turn in a frame, or in the tops of two stakes driven in the ground.

TO CAST THE BALLS. Weigh the lead; fill the kettle and cover it; as the lead melts add more, until it comes within 3 inches of the edge of the kettle; then cover it with a layer of powdered charcoal 1 in. thick; push the heat until paper in contact with the lead is inflamed by it; this requires from 1 to 2 hours.

Immerse the ladle and fill it about $\frac{3}{4}$ full of lead covered with charcoal, which is kept back with a piece of wood, in running the lead; fill all the moulds on

one side, then turn them and fill the other side; the first castings are thrown back into the kettle, being imperfect from the moulds being cold; the diameter of some of the balls is verified from time to time, with the gauges; the moulds must be carefully cleaned when it is perceived that the lead sticks to them, and if any moulds give imperfect balls, they must be filled with copper.

Extract the balls and trim them; in cutting, the ball should be gently pressed with the left fore-finger against the nippers, the gate being placed between the jaws.

To SMOOTH THE BALLS. Put 100 lbs. of them into the rolling barrel, and roll them for 3 minutes; or 50 lbs. into a bag and shake it five minutes; then run them through the screen, putting in 50 lbs. at a time; those which remain on the screen are re-cast.

With the above force 30,000 to 35,000 musket balls are made in 11 or 12 hours.

With proper care in observing the instructions, 100 lbs. of lead will give from 96 to 98 lbs. of balls.

PACKING. Balls are packed in boxes made of 1 in. boards, 9 in. square inside and 6 in. deep, containing 100 lbs. of balls or buckshot; they should be marked on end end with the weight and kind of balls, the place and date of fabrication; the top is fastened with six 2 inch screws, and the boxes must be hooped for transportation.

Making Cartridges

DIMENSIONS OF PAPER FOR CARTRIDGES		SHEETS		TRAPEZOIDS			
		Length	Breadth	Height	Long side	Short side	Number in one sheet
		In.	In.	In.	In.	In.	
Musket	Single ball, or ball and buckshot	16.5	13	4.33	5.25	3	12
	Blank	20	15	4	4.75	2.75	20
	12 buckshot	16.5	13	5.5	5	3	9
Rifle	Ball	16.5	13	4	4.25	2.25	16
	Blank	20	15	3	4.25	2.25	30
Pistol	Ball	16.5	13	3.3	4.25	2.25	20
	Blank	20	15	2.5	4.25	2.25	36

To CUT THE PAPER. 1 Cutter, 1 assistant.

Implements. 1 *Cutting board,* 30 in. square—1 *pattern,* of hard wood or iron, of the dimensions of each of the papers—1 *rule,* of hard wood, 33 in. long, 1.5 in. wide and 0.5 in. thick, to cut by—*2 laboratory* (shoe) *knives—2 sand stones,* for sharpening knives on.

The paper is first cut into strips of a width equal to the length of a trapezoid, and then into trapezoids, by means of the patterns; cut about 12 sheets at a time.

To MAKE THE CYLINDERS, 1 Master; 10 men to roll the cylinders; 1 to fill them, 4 to fold, 4 to bundle.. Boys from 12 to 18 years of age may be advantageously employed.

Implements and utensils, for each workman for making cylinders: *2 boxes* for the empty cylinders, made of ½ in. boards; interior dimensions, 20 in. long, 8 in. wide, and 5 in. high, without a cover; they are placed upon the sides, facing each side of the cartridge table which is furnished with brackets to receive them, and also with a small enclosure or *locker* for balls, at the right hand of each

workman—1 *spool of thread,* turning on a vertical iron spindle fixed in the table near the shot locker; 1 lb. of thread is required for 10,000 single ball musket cartridges, being 8½ inches to a cartridge—1 *choking string,* made by twisting together 4 or 5 cartridge threads; fastened to the edge of the table, at the right hand of the workman—1 *pair of scissors,* to cut the thread—1 *former,* cylindrical, of hard wood, of the same diameter as the ball; one end convex, the other concave, to receive ½ of the ball; length 6 or 7 inches.

Take the paper in the left hand, the former in the right; lay the paper on the table, with the side perpendicular to the bases towards the workman, the broad end to the left; place the former with its convex end at the broad end of the paper; turn it so as to envelop it with the paper, then with the left hand laid flat upon the paper, roll all the paper upon the former; seize it with the left hand, and with the choking string in the right hand, take one turn around the cylinder at about half an inch from the end, to which distance the end of the former is withdrawn; hold the former firmly in the left hand, and draw gently upon the choking string, pressing at the same time, with the left fore-finger, upon the projecting end of the cylinder, thus folding it neatly down upon the end of the former. Having choked the cylinder, carry it to the right side, and with the twine in the right hand, take two turns and a half hitch firmly around the part that has been choked; withdraw the former and introduce the ball, following it to the end of the cylinder with the former reversed; raise the whole again, and with the same thread, (which is never cut until the cartridge is finished,) take two half hitches just upon the upper side of the ball, between it and the concave end of the former; the operation is expedited by rolling the ball placed in the concave end of the former and choking the paper over it. Cut the thread and place the cartridge in the box which stands fronting the workman.

For ball and buckshot cartridges. Roll and choke the paper, put in 3 buckshot, follow them with the former, and take a half hitch of thread over them; then insert the ball as before.

Buckshot cartridges have 4 tiers of 3 buckshot each, inserted like the first, with a half hitch between them, and finishing with a double hitch.

Figure 21 shows the method of cartridge manufacture just described. Diagrams 1 to 4 illustrate rolling and choking the cylinder and securing the ball. Diagrams 5 to 8 show the method of folding, described in the paragraphs that follow.

For common rifles, the ball is prepared by being enveloped in a square piece of fine *muslin,* or of soft thin *leather,* or of *bladder,* tied over it and leaving a projecting end about ½ in. long, which, after being trimmed with scissors, and the whole saturated with tallow, is introduced into the paper cylinder which is choked over it and fastened by two turns and a double hitch.

Cylinders for blank cartridges are made by folding down the paper over the concave end of the charger, touching the fold with a little paste, and pressing it on a ball imbedded in the table for that purpose.

To FILL THE CYLINDERS. 1 Man to fill, 4 to fold, 4 to bundle.

Implements and utensils. I Large *copper pan* for powder.

1 *Charger* for each kind of cartridge, made of thin copper, with a handle at the top.

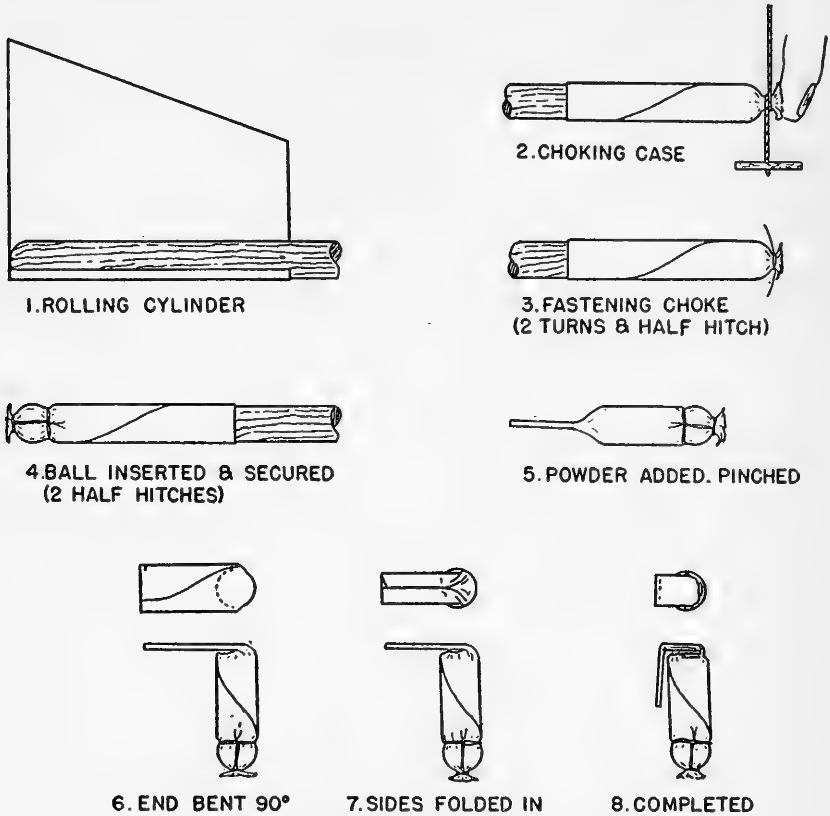


FIG. 21.—Cartridge manufacture, 1840 Ordnance Manual.

DIMENSIONS OF CHARGERS		MUSKET Ball	MUSKET Blank	MUSKETOON Ball	MUSKETOON Blank	RIFLE Ball	RIFLE Blank	CARBINE Ball	CARBINE Blank	PISTOL Ball	PISTOL Blank
		In.	In.	In.	In.	In.	In.	In.	In.	In.	In.
Diameter	top	0.6	0.6	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5
	bottom	0.8	0.8	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7
Height		1.48	1.3	1.32	1.2	1.2	1.1	1.18	1.05	0.8	0.7

1 *Funnel*, copper, of the following interior dimensions:

		In.
Diameter of funnel	superior	1.75
	inferior	0.5
Diameter of pipe		0.5
Height of funnel		1.
Length of pipe		1.25

The funnel has a ring handle 0.6 in. diameter, or a handle of copper wire about 6 in. long.

1 *Folding box* for each calibre, made with only two sides; width equal to

5 times the diameter of the ball, height equal to twice that diameter. Two strips of wood nailed on the table will answer the same purpose.

Take the boxes full of cartridge cylinders to the table in the filling room; as they are filled, incline the cylinders over from the empty ones; when all in one box are full, fold the paper down over the powder by two rectangular folds, and place the cartridges before the men who are to bundle them.

BUNDLING. Put a wrapper in the folding box and place in it 2 tiers of 5 cartridges each, parallel to each other and to the short sides of the wrapper, the balls alternating; wrap the cartridges, whilst in the folding box, by folding the paper over them; tie them, first in the direction of the length, then of the breadth, with a bit of twine fastened in a single bow-knot. A bundle of musket cartridges is usually made with 5 single ball and 5 ball and buckshot cartridges.

DIMENSIONS OF BUNDLES

KIND OF CARTRIDGE		Length (height of cartridge)	Breadth	Thickness	Mean weight of 100 bundles
		In.	In.	In.	Lbs.
Musket	Ball	2.37	3	1.3	77
	Buck and ball..	2.55	3	1.3	94
	Buck shot	2.75	3	1.3	92½
	Blank	1.83	3	1.3	19
Musketoon	Ball	2.	3	1.3	71
	Buck and ball..	2.18	3	1.3	87½
	Buck shot	2.43	3	1.3	85½
	Blank	1.39	3	1.3	13
Carbine; musket calibre	Ball	1.81	3	1.3	69
	Buck and ball..	2.	3	1.3	86
	Buck shot	2.31	3	1.3	83½
	Blank	1.32	3	1.3	12
Rifle	Ball	2.5	2.5	1.1	48
	Blank	1.9	2.5	1.1	14¾
Carbine; rifle calibre	Ball	2.1	2.5	1.1	44½
	Blank	1.58	2.5	1.1	11¾
Pistol	Ball	1.68	2.5	1.1	40
	Blank	1.12	2.5	1.1	7¾

Wrapping paper is but slightly sized, with a view to its being immersed, before using it, in a varnish made of bees-wax 4 lbs., linseed oil 1 gill, spirits of turpentine 2 galls., for the purpose of making the paper water proof.—See *Chapter* 13.

With the above mentioned force, 10,000 musket cartridges are made and bundled in 10 hours, being 1000 for each maker of cylinders.

Packing Cartridges

Ball cartridges are packed in kegs or boxes to contain 1000 each. Blank cartridges may be packed in powder barrels.

The second edition of the Ordnance Manual, which came out in 1849, contained what was for the most part a copy of the instructions for making cartridges just quoted. However, the percussion system

had been adopted meanwhile. This introduced changes in the powder charges, so the section dealing with chargers was revised to read as follows:

DIMENSIONS OF CHARGERS		110 grs.	75 grs.	30 grs.
		In.	In.	In.
Diameter	top	0.8	0.7	0.5
	bottom	0.6	0.5	0.4
Height		1.35	1.25	0.85

1 *Funnel*, copper, of the following interior dimensions:

		In.
Diameter of funnel	superior	1.75
	inferior	0.5
Diameter of pipe		0.5
Height of funnel		1.
Length of pipe		1.25

The funnel has a ring handle 0.6 in. diameter.

A charger, for filling cartridges much more expeditiously, is made by attaching to a large brass funnel two charging cylinders which communicate with one discharging pipe at the lower end. These cylinders are alternately filled and emptied by a reciprocating motion of the funnel pipe.

The bundling operation was also changed so as to include percussion caps, and to conform to the new cartridge dimensions brought about by reduction of the charge through omitting the priming. A new section was added on packing cartridges.

Bundling. Put a wrapper in the folding box and place in it 2 tiers of 5 cartridges each, parallel to each other and to the short sides of the wrapper, the balls alternating; wrap the cartridges, whilst in the folding box, by folding the paper over them; tie them, first in the direction of the length, then of the breadth, with a bit of twine fastened in a single flat knot.

A package of 12 *percussion caps* is placed in each bundle of 10 cartridges, at the end of the bundle.

The case for the caps is made like a cylinder for a rifle cartridge; it is choked at one end and tied; when the caps are inserted it is folded like a cartridge.

Dimensions of bundles of Percussion Cartridges

KIND OF CARTRIDGE		Length (height of cartridge)	Breadth	Thickness
		In.	In.	In.
Musket	Ball	2.6	3.1	1.35
	Buck and ball	2.90	3.1	1.35
	Buck shot	3.1	3.1	1.35
	Blank	1.83	3.1	1.35
Musketoon	Ball	2.5	3.1	1.35
	Buck and ball	2.18	3.1	1.35
	Buck shot	2.43	3.1	1.35
	Blank	1.39	3.1	1.35

Rifle	Ball	3.	2.6	1.15
	Blank	1.9	2.6	1.15
Hall's Carbine	Ball	2.1	2.6	1.15
	Blank	1.58	2.6	1.15
Pistol	Ball	2.	2.6	1.15
	Blank	1.12	2.6	1.15

Wrapping paper is but slightly sized, with a view to its being immersed, before using it, in a varnish made of bees-wax, linseed oil and spirits turpentine, for the purpose of making the paper water proof.—See CHAPTER VII.

1000 lbs. of paper require:

Bees-wax	133 lbs.
Spirits of turpentine	135 gallons
Linseed oil	10 gallons

With the above mentioned force, 10,000 musket cartridges are made and bundled in 10 hours, being 1000 for each maker of cylinders.

Packing Cartridges

Ball cartridges are packed in boxes to contain 1000 each. Blank cartridges may be packed in powder barrels.

Interior dimensions of packing boxes for 1000 Percussion Catridges

KIND	Depth	Length	Width	WEIGHT Empty	WEIGHT Packed
	In.	In.	In.	Lbs.	
Musket, buck and ball	6.75	15.5	11.75	12.	107
Musketoon, ball	6.75	15.5	9.	11.5	100
Rifle, ball	5.75	13.	11.75	11.	60
Hall's Carbine	5.75	13.	11.	9.	55
Pistol, ball	5.75	13.	8.	7.	45

The boxes are made of 1 in. white pine boards, and are furnished with wooden brackets or handles nailed to the ends; the lids fastened with four 1¾ in. screws. They are painted olive color. The kegs or boxes should be lined with strong water proof paper, and the bundles of cartridges must be closely packed, so as not to shake in transportation. Each keg or box should be marked, on both ends, with the number and kind of cartridges; on the inside of the cover, with the place and date of fabrication.

With the adoption in 1855 of a new series of arms came a new type of cartridge. This followed the French practice of placing the powder in a cylinder of heavy paper, wrapping that in cartridge paper, then finally wrapping again in a final paper with the bullet. The instructions for making such cartridges follow:[19]

Table of dimensions for formers for making cartridges with elongated expanding balls. (The dimensions are referred to the plate by means of the letters placed opposite them.) [Fig. 22.]

	Altered Musket	New Rifle Musket	Pistol Carbine	
	Inches	Inches	Inches	
a	3.5	3.5	3.5	Outer wrapper
d	2.5	2.25	2.25	
c	5.25	4.25	4.25	
a	1.1	1.	.8	Cylinder case
e	2.75	2.	2.	
f	1.5	1.3	1.1	Cylinder wrapper
g	2.75	2.2	2.2	
h	3.75	3.	3.	

The diameters of the round sticks on which the powder cases are formed should be .69 inch for the old, and .58 inch for the new calibre. This will make the exterior diameter of the case somewhat larger than the ball, and will prevent the outer wrapper from binding around its base when the cartridge is broken.

The outer wrapper should not be made of too strong paper: that prescribed in the Ordnance Manual for blank cartridges, and designated as No. 3, will answer a better purpose for these cartridges than that designated as No. 1. The cylinder case should be made of stiff rocket paper, No. 4; and its wrapper may be made of paper No. 1, 2, or 3.

Before enveloping the balls in the cartridges, their cylindrical parts should be covered with a melted composition of one part beeswax and three parts tallow. It should be applied hot, in which case the superfluous part would run off; care, should be taken to remove all of the grease from the bottom of the ball, lest by coming in contact with the bottom of the case, it penetrate the paper and injure the powder.

The balls being thus prepared, and the grease allowed to cool, the cartridges are made up as follows, viz: place the rectangular piece of rocket paper, called the cylinder case, on the trapezoidal piece, called the cylinder wrapper, as shown by the broken lines of the plate, and roll them tightly around the former stick, allowing a portion of the wrapper to project beyond both case and stick. Close the end of the case by folding in this projecting part of the wrapper. To prevent the powder from sifting through the bottom, paste the folds, and press them on to the end of the stick, which is made slightly concave to give the bottom a form of greater strength and stiffness.

After the paste is allowed to dry, the former stick is inserted in the case, and laid upon the outer wrapper (the oblique edge from the operative, and the longer vertical edge towards his left hand) and snugly rolled up. The ball is then inserted in the open end of the cartridge, the base resting on the cylinder case, the paper neatly choked around the point of the ball, and fastened by two half hitches of cartridge thread.

The former stick is then withdrawn, the powder is poured into the case, and the mouth of the cartridge is "pinched" or folded in the usual way.

To use this cartridge, tear the fold and pour out the powder; then seize the ball end firmly between the thumb and fore finger of the right hand, and strike the cylinder a smart blow across the muzzle of the piece; this breaks the cartridge and exposes the bottom of the ball; a slight pressure of the thumb and

fore finger forces the ball into the bore clear of all cartridge paper. In striking the cartridge the cylinder should be held square across, or at right angles to the muzzle; otherwise, a blow given in an oblique direction would only bend the cartridge without rupturing it.

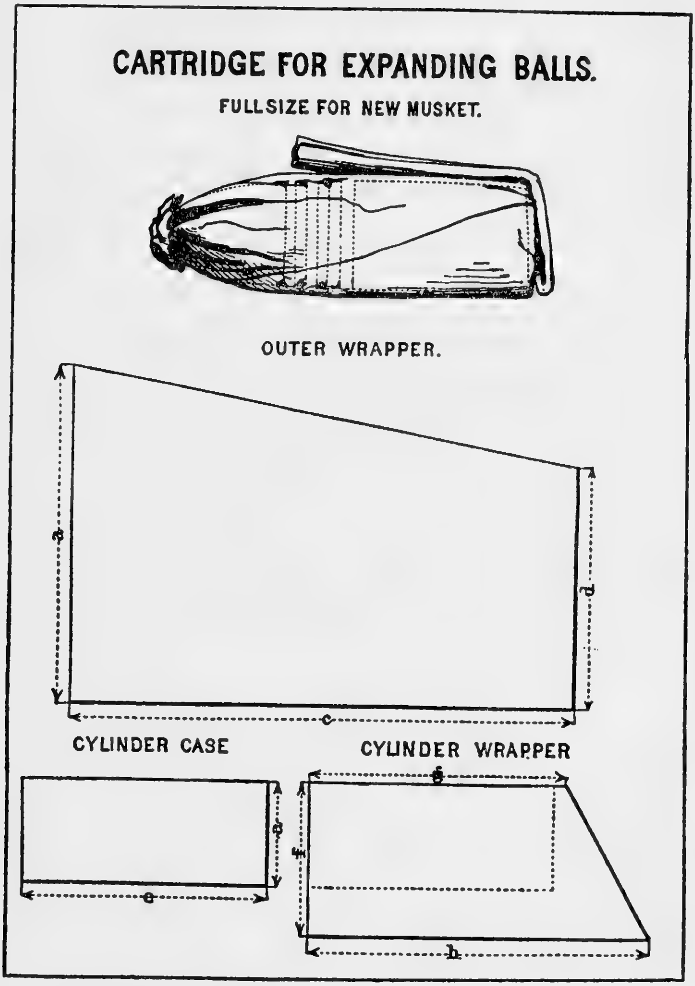


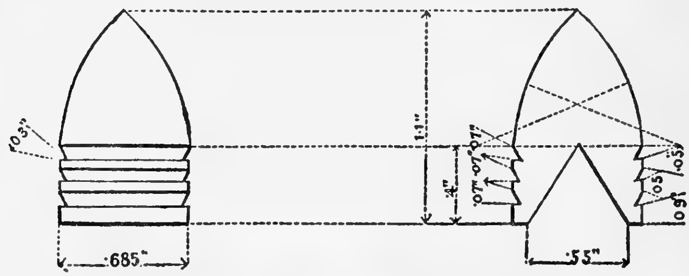
FIG. 22.—Cartridge for expanding balls (small arms, 1856).

Cartridges constructed on these principles present a neat and convenient form for carrying the powder and ball attached to each other, and they obviate two important defects of the elongated ball cartridges in common use, viz: the reversed position of the ball in the cartridge, and the use of the paper wrapper as a patch. So far as they have been tried in the hands of the troops, they have been found to answer a good purpose.

Figure 22 shows patterns for cartridge paper and figure 23 the bullets adopted in 1855.

For some reason not clear, the cartridge embodying a reinforced powder cylinder did not remain in favor. Before the start of the Civil

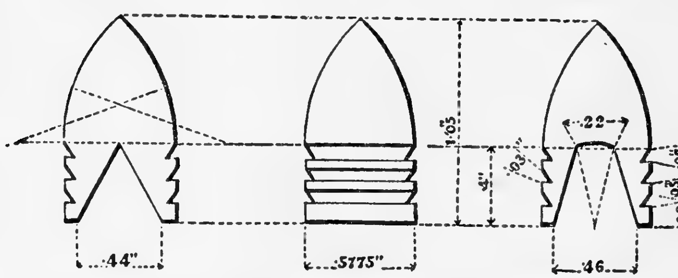
BALL FOR ALTERED MUSKET.



Weight of ball, 730 grains; weight of powder, 70 grains.

BALLS FOR NEW RIFLE-MUSKET AND PISTOL-CARBINE.

No. 1. **No. 2.**



Weight of No. 1, 500 grains. Weight of No. 2, 450 grains.
Weight of powder, 60 grains. Weight of powder, 40 grains.

No. 1, section of musket ball.
No. 2, section of pistol-carbine ball.
Both balls have the same exterior.

Fig. 23.—Ball for altered musket (small arms, 1856).

War the former method had been adopted again. Perhaps manufacturing cost entered into the picture. The third edition of the Ordnance Manual, printed in 1861, contained a completely new set of instructions for the manufacture of ammunition, as follows:

AMMUNITION FOR SMALL ARMS

There are two kinds of cartridges used in service,—the ball-cartridge, made with a single elongated ball, and the buckshot-cartridge, made with fifteen buckshot.

Ball-Cartridges

Making Balls.—Lead balls are made by compression, by means of machines for that purpose. Balls thus made are more uniform in size and weight, smoother, more solid, and give more accurate results, than cast balls.

The lead is first cast into round cylindrical bars, .58 and .63 inch in diameter for the calibres .58 and .69 inch respectively, and 21 inches long, and then rolled to .46 and .56 inch in diameter for the same calibres respectively; length, 25 inches. These bars are fed to the machine, which cuts off a part sufficient for one ball and transfers it to a die, in which the ball is formed, with cavity and rings, the surplus metal being forced out in a thin belt around the ball in the direction of its axis. The balls are trimmed by hand, with a knife, and are then passed through a cylinder-gauge of the proper size.

A day's work.—One man can make with the machine 30,000 balls in ten hours, the bars of lead being prepared for him. One man can cast 1,500 bars in 10 hours, and can trim and roll 2,000 bars in 10 hours. A boy can trim and gauge 5,000 in 10 hours.

Bullet-moulds are provided to cast balls, where the pressed balls cannot be had.

The mould is so constructed as to trim the balls by a single operation before they are taken from the mould.

Buckshot are compressed by machines in a similar manner to balls. They are also readily obtained from private shot-works.

To Grease the Balls.—Place them on their bases on a tin frame capable of holding about 50 balls, and immerse it in a melted mixture of 1 part of tallow and 8 of beeswax, kept warm, until the cylindrical part of the ball is covered. Remove the frame, and let it stand till the grease hardens.

Three frames are required for each boy.

To Cut the Paper

Workman.—1 *cutter.*

Materials.—*Paper and pencil.*

Implements.—1 *cutting-board,* 30 inches square; 1 *iron ruler,* 33 inches long; 1 *lever,* 1 *cord,* 1 *large knife,* 1 *sandstone,* 1 *trapezoid of hard wood or iron.*

Cut the paper first into strips of a width equal to the length of a trapezoid, and then into trapezoids, using the pattern as a guide.

The paper and ruler are kept from moving by means of a lever, one end of which is fixed and the other is moved by the foot by means of a cord and treadle.

The knife is held in both hands.

From 6 to 8 reams may be cut at a time in this way.

A cutting-machine, like that used by bookbinders, facilitates the operation when many hands are employed.

When only a knife and ruler are used, about 12 sheets are cut at a time.

To Make the Cartridge

Workmen.—1 *master,* 10 *boys.*

Implements *for each boy.*—2 *boxes* to hold cylinders, 20 inches long, 8 inches wide, and 4 inches high, in the clear, made of ½-inch boards, without a cover: they are placed on their sides, their backs inclined against the partition in the middle of the cartridge-table, the front resting on cleats nailed to the table; 1 *former,* cylindrical, of hard wood, of the same diameter as the ball, 6 to 7 inches long, one end pointed, almost as much as the ball, and marked with a shallow groove 4.0 inches from the end; 1 *sabot or frame,* tacked to the table, to hold

balls, placed at the left hand of the boy; 1 *spool* of thread, turning on a vertical spindle fixed in the table near the balls; 1 *choking-string,* made of 4 or 5 cartridge-threads twisted together, about 9 inches long, with a wooden toggle at the end,—fastened to the edge of the table at the right hand of the boy; 1 *knife-blade,* 1½ inch long, hooked, driven into the front of the table below and near the choke-string.

To Form the Cylinder.—Lay the trapezoids on the table with the side perpendicular to the bases toward the workman, the broad end to the left.

Take the former in the right hand and lay it on a trapezoid, the groove in the former against the right edge of the paper, bringing the pointed end ⅓ inch from the broad end of the paper; envelop the former with the paper; then, with the fingers of the left hand laid flat upon the paper, turn the former and roll all the paper upon it; hold it with the left hand, and, with the choking-string in the right, take one turn around the cylinder at about ⅓ inch from the end; hold the former firmly in the left hand, and draw gently upon the choking-string, pressing at the same time with the left forefinger upon the projecting end of the cylinder, thus folding it neatly down upon the end of the ball. Having choked the cylinder close, carry it to the right side, and, with the thread in the right hand, take two half-hitches firmly around the part that has been choked; cut the thread on the knife-blade, and press the choke in a cavity in the table; place the former, with a cylinder on it, on a second trapezoid; put a ball over the end of the former; roll the paper on the former and the ball; hold the cylinder in the left hand and choke and tie it as just described for the inner cylinder; withdraw the former, pressing the cylinder with the left hand, and place it in the box.

A day's work.—A boy can make 800 cylinders in 10 hours.

To Fill the Cylinder

Implements.—1 *charger,* made of a cylinder of wood or brass pierced with two holes through its length, holding the exact charge of powder; a funnel attached to one end of the cylinder, and a discharge-pipe to the other. The holes in the cylinder are made to communicate and shut off, alternately, from the funnel holding the powder, and the discharge-pipe at the lower end, by a reciprocating motion given to the cylinder by the hands.

Fill the funnel with powder; insert the discharge-pipe in a cartridge, holding the charger in both hands, and turn the cylinder; the charge of powder is deposited in the cartridge: insert the pipe in the next, and turn the cylinder in the opposite direction; and continue in the same way for all the rest.

Cartridges may be filled with a copper charger made to hold the exact charge, pouring the powder by means of a small funnel which is inserted in the cartridge.

To Pinch the Cartridge.—Take the cartridge in the right hand, strike it lightly on the table to settle the powder; flatten the empty part of the cylinder, and bend it, flush with the top of the powder, at right angles to the cartridge, the oblique side of the trapezoid on top, the cartridge standing vertical on the table; fold the flattened part in the direction of its length with two folds from the exterior, meeting in the middle; bend this folded end back on itself, and strike it on the table to set the folds.

The method of forming the cylinder and securing the ball just described is shown by figure 24, diagrams 1 to 4. Succeeding steps are the same as in the 1840 Manual, shown by figure 21, diagrams 5 to 8.

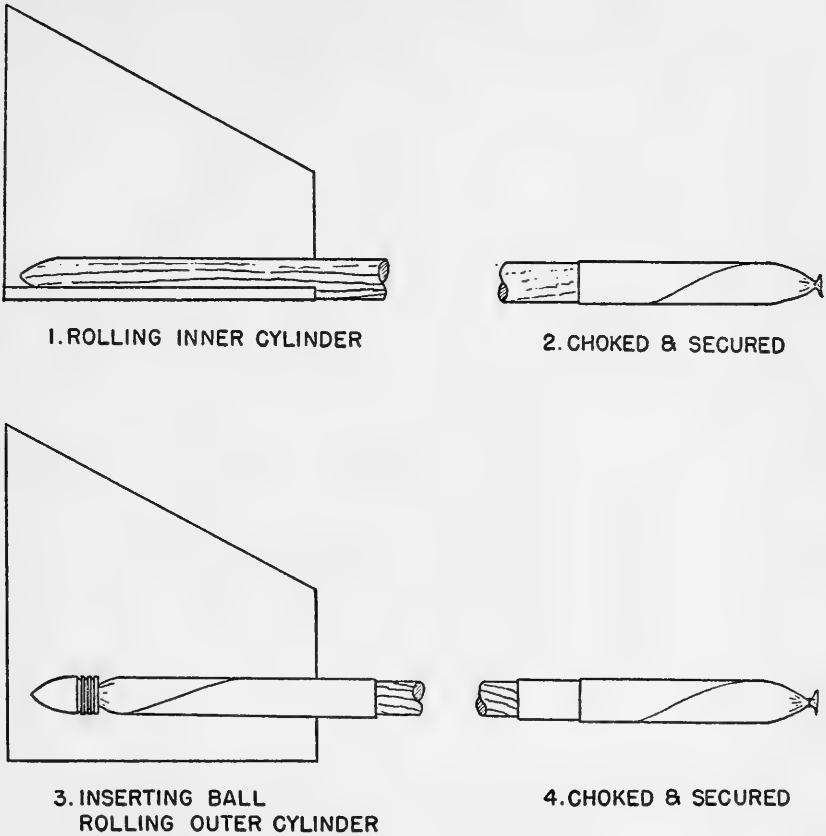


FIG. 24.—Cartridge manufacture, 1861 Ordnance Manual.

TO BUNDLE CARTRIDGES

UTENSILS.—1 *box* without ends or top: width equal to 5 times the diameter of the ball, height equal to twice that diameter, and length that of the cartridge. It is tacked to the table, the sides parallel to and near the edge of the table.

Put a wrapper in the box, the long side perpendicular to the edge of the table, the middle of the paper in the middle of the box; place, parallel to the sides of the box, two tiers of cartridges of 5 each, the balls alternating; bring the short ends of the paper together, and fold them twice close down on the cartridges; insert a package of caps in the end of the bundle next to the ends of the lower tier; fold the wrapper on the ends, and tie the bundle, first in the direction of the length, then its breadth, with the twine fastened in a single bow-knot. The wrappers are of different colors, to distinguish the cartridges for the different arms.

CASES FOR PERCUSSION-CAPS.—These are rolled on a former, .54 inch in diameter, choked at one end and tied. Twelve caps are put in, and the case is closed by twisting the open end of the case.

PACKING CARTRIDGES.—Cartridges are packed in boxes containing 1,000 each. Five tiers of bundles are laid flat in a single row along one side of the box; the rest are placed on edge, the caps alternately up and down. *Blank cartridges* are packed in boxes containing 2,000 each; the bundles are placed on end, the caps alternately up and down.

Packing-boxes.—The boxes are made of white pine boards, dovetailed and nailed together, and are furnished with wooden brackets or handles nailed to the ends with wrought nails, clenched on the inside; the lids fastened with six 1.75 inch screws. They are painted different colors, to indicate the kind of cartridges. The boxes should be lined with strong paper, and the bundles of cartridges must be packed closely, so as not to shake in transportation. Each box should be marked, on each end, with the number and kind of cartridges, and on the inside of the cover with the place and date of fabrication.

Blank Cartridges

MATERIALS.—*No. 2 paper; paste; powder.*

Cut the paper into trapezoids as for ball-cartridges; roll the trapezoid on the former, one turn; fold down this much of the paper on the head of the former with the left hand; roll the rest of the paper; fold down the rest of the paper; touch the fold with a little paste on the finger; press the end of the former on a ball imbedded in the table for the purpose; remove the cylinder from the former; place it in a box to dry.

Fill the cylinders as described for ball-cartridges.

A day's work.—One boy can make 2,000 cylinders in 10 hours.

Packing Musket-Balls

Balls are packed in boxes with tow or sawdust, to prevent their bruising. The boxes are made of 1-inch boards, and contain 1,000 balls.

They are marked on both ends with the number and kind of balls, and on the inside cover with the place and date of fabrication. The cover is fastened with six 2-inch screws, and the boxes must be hooped with iron for transportation. They are not painted.

During the Civil War the United States made or purchased over 470,000,000 caliber 0.577 or 0.58 paper cartridges and over 230,000,000 for other muskets, including foreign arms. Over 21,000,000 blanks were procured also. Confederate production, too, was at a high level. According to Fuller and Steuart [20] the Confederacy made over 36,000,000 rounds of musket ammunition during the year ended September 30, 1863.

A manual for volunteers and militia of the Confederate States was published in 1862.[21] This text included a section on ammunition as follows:

AMMUNITION

57. When troops are in the field it is not only necessary that they should go with a sufficient supply of ammunition, but that it should be put up in such form

TABLE 8.—CARTRIDGE SPECIFICATIONS—1861 ORDNANCE MANUAL

Cartridges for Small Arms

KIND OF CARTRIDGE	EXPANDING BALL			BLANK	ROUND BALL		ELONGATED BALL			
					Musket, 1842					
Kind of Arm	Musket of 1842	Musket and Rifle, 1855	Cadet Musket, 1857	Musket and Rifle, 1855	Ball	Buckshot	Pistol Carbine	Revolver, Army	Revolver, Navy	Sharpe's Carbine
Calibre ... in.	.69	.58	.58	.58	.69	.69	.58	.44	.38	.54
Ball — Diameter ... in.	.685	.5775	.5775		.65	....	.5775	.46	.39	.56
Ball — Weight ... grs.	730	500	450		412	....	450	216	145	475
Charge of powder ... grs.	70	60	50	60	110	110	40	30	17	50
Trapezoid — Height ... in.	4.33	4.12	4.12	3.75	4.33	5.5	4.1	2.75	2.4	3
Trapezoid — Long base ... in.	4.5	4.0	4.0	4.16	5.25	5.0	4.0	3.25	2.5	3.25
Trapezoid — Short base ... in.	2.7	2.5	2.5	2.5	3.0	3.0	2.5	1.6	1.6	2.25
No. of trapezoids in 1 sheet ...	12	16	16	24	12	9.	16	30	40	34
Wrapper — Length ... in.	10.	9.	9.	....	9.	....	9.	8.	7.5	10.
Wrapper — Width ... in.	8.	6.5	6.5	....	6.5	....	6.5	6.5	4.9	6.8
Wrapper — No. in a sheet ...	4	6	6	....	6	....	6	6	12	4
Wrapper — Color ...	Ordinary	Ordinary	Red	Ordinary	Green	Red	Blue	Ordinary	Blue	Ordinary
Thread for 1,000 ... oz.	0.5	0.5	0.5	....	0.5	0.5	0.5	0.5	0.5	0.5
Weight of 10 cartridges ... oz.	19.5	13.5	13.	....	13.2	....	12.5	6.	5.	13.5
Bundles of 10 — Length ... in.	2.5	2.6	2.5	....	2.6	3.1	2.4	2.3	2.20	2.6
Bundles of 10 — Width ... in.	3.4	2.9	2.9	....	3.1	3.1	2.9	2.0	1.9	2.5
Bundles of 10 — Depth ... in.	1.45	1.15	1.15	....	1.35	1.35	1.15	.85	.85	1.1
Size of packing-boxes for 1,000 cartridges — Length ... in.	14.0	14.75	....	15.5 [1]	15.5	15.	....	13.1 [2]	10.5 [2]	14.75
Size of packing-boxes for 1,000 cartridges — Width ... in.	12.0	10.75	....	11.0	11.75	10.75	....	4.6	3.8	8.9
Size of packing-boxes for 1,000 cartridges — Depth ... in.	7.0	6.38	....	6.25	6.75	6.38	....	3.5	3.25	5.2
Weight of box packed ... lbs.	135	98	....	....	107	....	....	28.5	16.5	78.
Color of box ...	Lead	Olive	Gray	Olive	Blue	Red	Yellow	Olive	Blue	Olive
Packing-boxes for 1,000 balls — Length ... in.	9.75	8.25	8.25	....	7.25	....	5.25	....	....	....
Packing-boxes for 1,000 balls — Width ... in.	9.75	8.25	8.25	....	7.25	....	5.0	....	....	....
Packing-boxes for 1,000 balls — Depth [2] ... in.	5.25	5.0	4.25	....	5.0	....	4.25	....	....	....
Packing-boxes for 1,000 balls — Weight [2] ... lbs.	107.	73.	59.5	....	65	....	59.5	....	....	....

[1] For 2,000 cartridges.

[2] Contains 600 cartridges: box made of .75-in. boards. If the balls be packed in tow, add ½ in. to the depth of the box. *Burnside's Cartridges.*—Box 14.4 × 11.2 × 6.2. Weight, 87.5 lbs.

as to be convenient for use, and at the same time as well protected as possible from the effects of the weather, etc. Cartridges made of paper or flannel, or some other woollen goods, are in general use; the former for small arms, and the latter for artillery.

58. To make the cylinders for blank cartridges, the paper is cut in the form represented in fig. 15, with a pattern. The *former* is a cylinder of hard wood of the same diameter as the ball, concave at one end and convex at the other. The paper is laid on a table with the side perpendicular to the bases next the workman, the broad end to the left, the former laid on it with the concave end half an inch from the broad edge of the paper, and enveloped in it once. The right hand is then laid flat on the former, and all the paper rolled on it. The projecting end of the paper is now neatly folded down into the concavity of the former, pasted and pressed on a ball imbedded in the table for the purpose.

Instead of being pasted, these cylinders may be closed by choking with a string tied to the table, and having at the other end a stick by which to hold it. The convex end of the former is placed to the left, and after the paper is rolled on, the former is taken in the left hand, and a turn made around it with the choking string, half an inch from the end of the paper. While the string is drawn tight with the right hand, the former is held in the left, with the forefinger resting on the end of the cylinder, folding it neatly down upon the end of the former. The choke is then firmly tied with twine. [Text figures 15, 16, 17 are included in our figure 25.]

59. For ball cartridges the cylinders are made and choked as above, and the choke tied without cutting the twine. The former is then withdrawn, the ball inserted, and followed by the concave end of the former. Two half-hitches are made just above the ball, and the twine cut off.

For ball and buckshot cartridges make the cylinder as before, insert three buckshot, fasten them with a half-hitch, and insert and secure the ball as before.

For buckshot cartridges make the cylinder as before, insert four tiers of three buckshot each, as at first, making a half-hitch between the tiers, and ending with a double hitch.

60. To fill the cartridges the cylinders are placed upright in a box, and the charge poured into each from a conical charger of the appropriate size; the mouths of the cylinders are now folded down on the powder by two rectangular folds, and the cartridges bundled in packages of ten. For this a folding-box is necessary; it is made with but two vertical sides, at a distance from each other equal to five diameters of the ball and two diameters high.

Put a wrapper in the folding-box, and place in it two tiers of five cartridges each, parallel to each other and to the short sides of the wrapper, the balls alternating; wrap the cartridges while in the folding-box, by folding the paper over them, and tie them. A package of twelve *percussion caps* is placed in each bundle of ten cartridges.

The bundles are marked with the number and kind of cartridge.

61. The cartridges for elongated projectiles differ so much from those used with the spherical bullet that a separate description is necessary.

Each cartridge is made of three pieces of paper—the larger piece or cartridge proper (see fig. 16, No. 1) is made of what is known as cartridge paper, but it should not be too strong; the second piece (No. 2) is made of the same or stronger paper, and the third (No. 3) is made of the stoutest rocket paper.

Before enveloping the balls in the cartridges, their cylindrical parts should be covered with a melted composition of one part beeswax and three parts tallow; it should be applied hot, in which case the superfluous part would run off. Care should be taken to remove all the grease from the bottom of the ball, lest by coming in contact with the bottom of the case it penetrate the paper and injure the powder.

62. The sticks on which the cartridges are rolled are made of the same diameter as the bore of the piece; the dimensions given are for the U. S. musket or rifle of 0.58 bore. The piece of stiff paper, No. 3, is laid upon No. 2, as shown in the dotted line of the figure; the stick is laid down on the side *a, b, c,* the end being at *b,* and the paper rolled around it; the projecting end is then folded down and pasted. After the cylinder thus made is dry, it is again put on the stick; the stick is then taken in the left hand and laid upon the outer wrapper, the end not far from the middle of the wrapper (the oblique edge of the wrapper turned from the workman, the longer vertical edge toward his left hand), and snugly rolled up. The ball is then inserted in the open end of the cartridge, the base resting on the cylinder case, the paper neatly choked around the point of the ball, and fastened by tying with cartridge thread. The stick is then withdrawn, sixty grains of powder poured into the case, and the mouth of the cartridge is "pinched" or folded in the usual way. The cartridge is shown in fig. 17.

63. To use this cartridge, tear the fold and pour out the powder; then seize the ball end firmly between the thumb and forefinger of the right hand, and strike the cylinder a smart blow across the muzzle of the piece; this breaks the cartridge and exposes the bottom of the ball; a slight pressure of the thumb and forefinger forces the ball into the bore clear of all cartridge paper. In striking the cartridge the cylinder should be held square across, or at right angles to the muzzle; otherwise, a blow given in an oblique direction would only bend the cartridge without breaking it.

The Confederate Ordnance Manual [22] was practically a copy of the 1861 edition of the United States Ordnance Manual. The part pertaining to ammunition was identical. Other manuals were published in the South, however. One of these, the Field Manual,[23] mentions briefly an entirely new scheme of cartridge fabrication.

How to make Cartridges

When the cylinder of paper is not attached to the ball by the pressure of machinery closing the annulus around the base of the ball, as is usually done in the C. S. service, cartridges should be made with *thin wrappers.* The first, or inner paper envelope, is made by rolling with the hand the paper around a cylindrical mould, generally of wood, with a conical cavity at one end, to fit the cone of the ball. Besides this paper, a little rectangle of paste-board is also rolled, and the paper projecting beyond, pressed into the hollow of the mould, thus making a cylinder in which to receive the powder. The ball is then placed against the mould, *the point of the cone in the hollow of the mould,* and a *third wrapper* of thin, strong paper, in shape of a trapezoid, rolled and pasted around ball and powder. The cartridge is terminated by a compressed fold at the end with the powder, and tied with twine below the ball. The outer wrapper is then

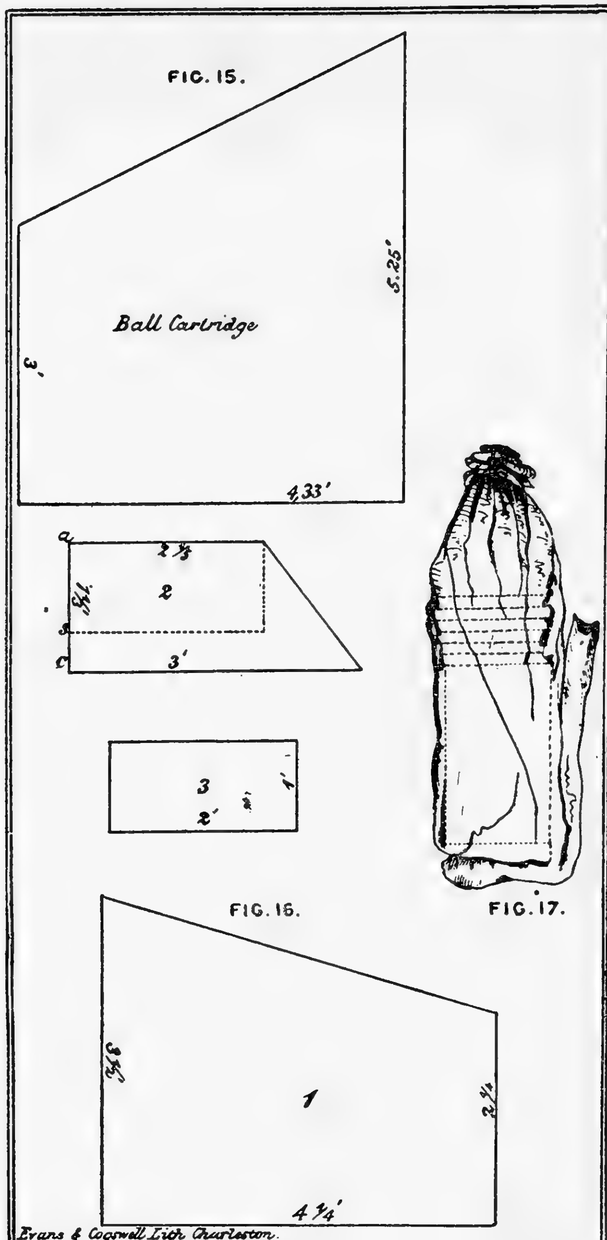


FIG. 25.—Cartridge paper, CSA.

lubricated around the ball, with a mixture of two parts of bleached wax and one of tallow.

Buckshot cartridges have 4 tiers of 3 buckshot each, inserted like the first, with a half hitch between them, and finishing with a double hitch.

A footnote in the Confederate Ordnance Manual refers to this new type cartridge as follows: "A method of attaching the paper cartridge directly to the ball has recently been invented by F. J. Gardner, and is used in the Confederate Laboratory at Richmond." General Pitman noted that William Watson, former master armorer at Fayetteville, told him such cartridges were made at Fayetteville as well as at Richmond, and were known as "Fowler" cartridges. I have been unable to run down the Fowler connection. Federal records call this type "inserted paper" cartridge. Specimens of this construction are shown on plate 33. Battlefield specimens of the Gardner bullets are often called "two-piece" bullets, the circumferential slit in the base making them resemble two parts of one of the composite (Shaler) bullets swaged together by firing.

The second-type construction, described in the Field Manual in some detail, resembles the British Enfield system of manufacture.

Most of the European paper cartridges used during the Civil War in the United States varied only in details from the American types. In general, the envelope was made by rolling paper around a cylindrical former, usually made of wood. The only differences were in the manner of closing or tying the cartridge or in the use of a second case placed inside the first to separate ball and powder and to strengthen the cartridge mechanically.

There were two general classes of cartridges. In the first the ball was placed in the same container as the powder. The case was tied with string either around or above the ball and the powder was closed off either by twisting the paper or by a double fold.

In the second class the powder and ball were separated. One means of doing this was that used in the Prussian needlegun cartridge in which a pressed paper sabot, made to fit the ball at one end, contained fulminate priming mixture at the other. Some cartridges were tied between ball and powder. Others were made with a cardboard cylinder under the wrapping paper. The projecting end of this cylinder was pasted and bent shut so as to close one end. The ball was placed next to this closed end and another piece of paper rolled around the whole.

The British Enfield cartridge differed somewhat from most others

in its construction. Busk [24] describes the official British procedure for manufacturing ammunition:

The result of hundreds of thousands of experiments at Hythe and elsewhere proves, as Colonel Wilford assures us, that "the auxiliary to expansion, derived from the wooden plug, gives vastly increased accuracy at long ranges, when compared with the Pritchett bullet." This remark, of course, applies only to the Enfield bullet, for both upon Jacob's and Whitworth's principles, the annihilation or reduction to a minimum of windage, being attained, as previously observed, by mechanical fit, any adventitious aid like that derivable from the plug, is, with either of these rifles, wholly superfluous.

General Hay it was, who proposed the substitution of a box-wood plug of conoidal form, for the small iron-cup, and there is no doubt but that it fully answers the purpose intended by its ingenious inventor, and that its utility is plainly manifest at all ranges beyond 700 or 800. These plugs are formed in a machine, of the character of a lathe, of rather complicated aspect, which turns them out at the rate of 10,000 a-day, at the cost of about 1*d.* per 100.

Before being fitted into the bullet, they are coated by immersion, with a thin film of wax. Each bullet before being plugged is examined, and if any defect appear, it is rejected. If not, the plug is pushed evenly into the cavity at its base. The bullets are now gauged by means of a ring, one thousandth of an inch larger than the bullet. They are then arranged in trays, so that the apex of each, alone is visible; should the slightest defect be perceptible in any one, that bullet is summarily rejected. The rest are removed to another room to be made up into cartridges. As this manufacture very properly constitutes an important part of the course of instruction taught at Hythe, I will describe the process.

The paper principally used, is that known as "White fine," the size of the sheets is 29 in. by 19⅝, the reams weigh 13 lbs., and the price is about 1*l.* 6*s.* A few sheets from each ream, are examined as to toughness, regularity of texture, smoothness of surface. The external covering of each cartridge is of a stouter quality. These sheets are 25 in. by 19 in. The reams weigh 45 lbs. and cost 1*l.* 5*s.* 6*d.* each. The twine for tying the cartridges is that known as "3-ply," and cost about 1*s.* 8*d.* per lb.

Great care must be taken that, whatever the paper used, it may not increase the diameter of the bullet, when the cartridge is completed, more than 9 thousandths of an inch.

The implements requisite are three tin patterns of the shape and dimensions shown in the woodcuts opposite, and, in addition, a former, represented in the margin [figs. 26, 27]:—

A plug, a pair of strong scissors, knife, piece of catgut, choking pin, fixed to the table, a tray for the bullets, a box for the finished cartridges, a steel gauge through which each cartridge should pass easily.

Having cut the paper according to the size and patterns shown at the preceding page, for cartridges for the long or short rifles, the next step is to

1. *Form the powder-case.*—For this purpose roll the stiff paper, pattern No. 1, tightly about 2½ times round the "former" or "mandrel" which is to be laid on the side opposite the acute angle, or A,B, with its base coincident with the broader side, or A,D; then place the "inner envelope" paper, pattern No. 2, on the top of the stiff paper, with the side opposite the acute angle, or A,B, of the former about ¾ of an inch from the acute angle, or CD of the latter, and

roll said envelope tightly on the stiff paper and mandrel; after which slightly twist the end that overlaps about $\frac{7}{8}$ of an inch, or A,C, and fold it into the hollow at the base of the mandrel, making use of the point of the "former," to close the

PATTERNS FOR CARTRIDGE PAPERS.

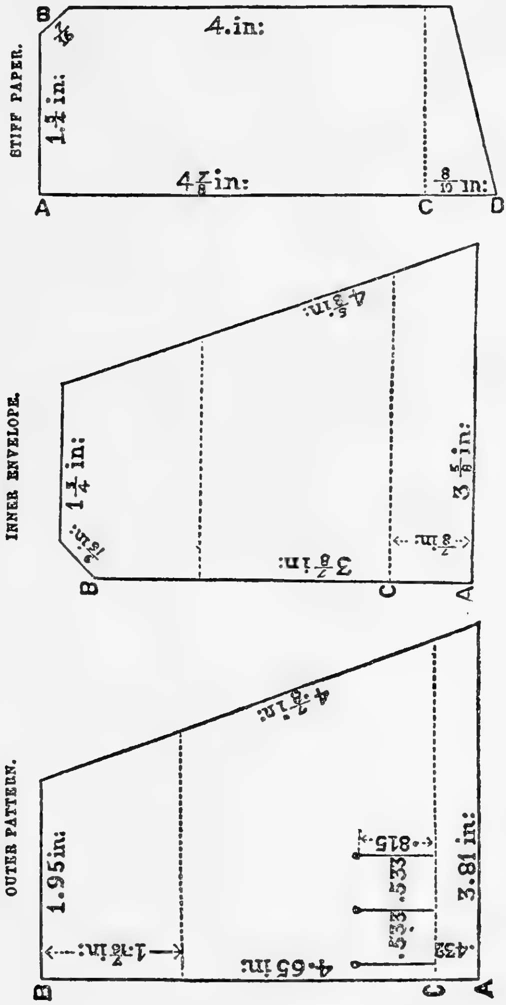


FIG. 26.—Cartridge paper, British specifications.

folds and adapt the paper to the cavity, which is to receive the point of the bullet, being careful to secure the bottom of the powder-case, so that no powder can escape therefrom.

2. Unite the bullet with the powder-case.—Put the point of the bullet well into the cavity of the powder-case, and place both so fixed on the side of "outer

envelope" paper, pattern No. 3, opposite the acute angle, or A,B, and about ½ an inch from the broader side, or A,C; roll the "outer envelope" tightly round bullet and powder-case, with the mandrel still in it, then twist or fold the paper that overlaps, and tie it, by means of 2 half hitches, as closely as possible to the base of the bullet; after which, place the base of the cartridge on the table, and withdraw the mandrel with care, by pressing the powder-case with one hand while raising the mandrel with the other, so as not to separate the powder-case from the bullet, both of which must be kept as close as possible to prevent any play or movement at the juncture, which would soon render the cartridge unserviceable.

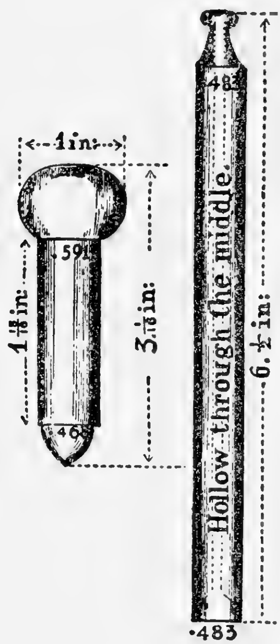


FIG. 27.—Cartridge former, British.

3. *Charge the powder-case.*—Place a small tin funnel into the mouth of the powder-case and pour 2½ drachms of powder (or a less quantity, according to the arm used) into it; remove the funnel, being careful that none of the powder escapes between the inner and outer envelopes; and secure the charge, by squeezing the tops of the two envelopes close to the stiff paper of the powder-case, and giving them a slight twist with a pressure inwards, lay the ends on the side of the cartridge.

The three slits, shown in the outer envelope, are made to facilitate its detachment from the bullet when fired.

4. *Lubricate the cartridge.*—The cartridge being completed, dip the base, up to the shoulder of the bullet, in a mixture composed of 11 parts of beeswax and 1 part of petroleum, or mineral oil.

Formerly, a mixture of 5 parts wax and 1 of tallow was used. It was kept

at an uniform temperature of 230° Fah. For private use, an ordinary glue-pot will answer perfectly the purpose of the more cumbersome apparatus necessarily employed at Woolwich.

To those who object to the trouble of making up their own ammunition, the information may be of service, that perfectly waterproof cartridges of the exact Government gauge, are purchaseable at Anthony's (37, Broad Street, Birmingham). They are sold in boxes, containing 1000 ball cartridges, for 70*s*., or 1000 blank for 45*s*.

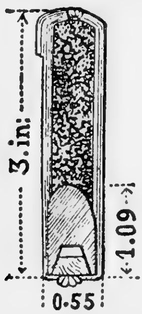


FIG. 28.—Enfield, model 1853 cartridge.

The figure in the margin, represents the longitudinal section of a regulation cartridge, and shows the relative position of the ball and the powder. Of late, a very ingenious form of blank cartridge has been devised, with a view to obviate the necessity of teaching the soldier to practise a different system of loading at one time, from that which he has to adopt when on actual service.

The old plan was, to bite off the end of the paper bag, to empty the powder down the barrel, and ram the bag itself home upon the charge. With the new blank ammunition, which externally resembles the ball cartridge, the soldier has to go through precisely the same motions, that he would have to perform were he firing in earnest.

The cartridges in question, are made in the form of bags from pulp, one fitting into the other. The inner bag has a hollow at the base, the other is a plain cylinder with a flat base. The part, containing the imitation bullet, is lubricated externally; into the upper part of this case, the mock bullet, formed of powder, encased in a small muslin bag, is inserted at the top, where the leaden bullet would otherwise be. At the junction—for the sake of distinction—a purple paper band, half an inch wide is pasted. This muslin bullet is twisted off and treated precisely in the same manner as its more deadly prototype.

One great advantage of this kind of blank ammunition is, that owing to the lubrication, the interior of the barrel is not fouled or rendered unfit for subsequent ball practice.

The following table shows the charges, diameters of the bullets, &c., of the principal small arm cartridges now in use.

SMALL-ARM CARTRIDGES

Nature of Cartridges	Charge	No. of Bullets to a Pound	Diameter of Bullet	Diameter of "Former"
	Drachms		Inches	Inches
Blank for all arms	3.50	....	...	.65
Lancaster elliptic rifle	2.50	.10	.28	.65
Rifle musket (pattern 1853)	2.50	13.50	.55	.472
" " (sea service 1853)	2.50	13.50	.568	.5
Carbine (carbine bore)	2.50	20.	.610	.59
Pistol (musket bore)	2.50	14.50	.680	...
" (carbine ")	2.	20.	.610	...

Most earlier British rifle ammunition was made in a manner similar to that for the Model 1853 (Enfield) rifle-musket, just described. Hawes [25] lists the dimensions of paper for making the common British types (see table, p. 199).

French and American practices in cartridge making were similar. An official French publication of 1850 [26] gives the details of cartridge manufacture, complete quotation of which would scarcely be worth while (see table, p. 201). A few items mentioned will be summarized briefly.

The ball and powder for charging small arms were put together in a paper envelope. These cartridges were then wrapped in packets, each containing a roll of percussion caps. There were two general types of cartridges, the infantry (round ball) for smooth-bore arms and the elongated ball for rifled arms. For the dragoon musket, musketoon, and pistol the soldier discarded a part of the powder to reduce the charge conveniently.

Balls of all kinds were tested by a gauge having two holes, which differed in diameter by 0.2 mm. The height of the trapezoid for a cartridge was twice the height of the powder charge plus three times the diameter of the ball. The height of the charge was about 5 mm. per gram (0.01275 inch per grain). The long base of the trapezoid was $2\frac{1}{2}$ times the circumference of the ball. The short base was half the long. The paper rectangle for wrapping caps was the same as that required for two trapezoids. The packet was made from a rectangle three times the last. The mandril for forming cartridges was about 0.6 mm. (0.023 inch) less in diameter than the ball to be used.

In inspecting small-arms ammunition, the French examined one packet in 100. The length, breadth, and height of the packet had to be within 4, 2, and 2 mm. (0.157, 0.078, and 0.078 inch) of the standard, respectively. The string was checked to see that it was well tied. The total weight had to be within prescribed limits. All 10 cartridges had to enter a gauging cylinder. The cartridges were then opened and all charges weighed. The total weight had to fall within

TABLE 9.—BRITISH SMALL-ARMS AMMUNITION, 1859

DIMENSIONS OF PAPER, &C. FOR SMALL-ARM CARTRIDGES

DESCRIPTION OF CARTRIDGE		Forming Paper: Description	Breadth	Longest side	Shortest side	Slip or Packing: Description	Length	Breadth	Wrapper: Description	Length	Breadth
			In.	In.	In.		In.	In.		In.	In.
Blank for all arms......		Purple.	4.4	5.8	3.25	......	...	..	Purple	11	5.75
Rifle Musket (1842)	1st Cylinder	Yellow wrapping	1.66	5.0	4.55						
	2nd Inside..	Yellow fine	4.3	5.6	3.5	Yellow fine	17.5	4	Yellow wrapping	9.75	6.25
	3rd Outside...	Y.F.	4.52	5.6	3.4						
Rifle Musket (1851)	1st Cylinder	Red wrapping	1.68	4.97	4.57						
	2nd Inside....	Red fine	4.05	4.65	2.52	Red fine	17.5	4	Red wrapping	9.75	6.25
	3rd Outside...	R.F.	4.45	4.57	2.33						
Rifle Musket (1853)	1st Cylinder..	Wrapping	2.05	5.05	4.5						
	2nd Inside....	W.F.	4.5	3.85	2.03	White Brown	17.5	4	Wrapping	9.75	6.25
	3rd Outside...	W.F.	4.65 4.65	3.81 3.67	1.95 1.95	for .55 bullet.					
Musket (Ordnance) ... Carbine (Victoria) M.B.		W.F.	4.3	6.65	5.25	White Brown	17.5	4	Wrapping	9.75	5
Musket (Common)		White fine	4.7	6.8	4.8	White fine	17.5	3	Wrapping	9.75	6.25
Artillery Carbine (1853)	1st Cylinder..	Wrapping	1.7	5.0	4.55						
	2nd Inside....	W.F.	3.43	3.8	2.45	W.B.	17.5	4	do	8.3	6.25
	3rd Outside...	W.F.	4.15	3.8	2.2						
Lancaster Rifle	1st Cylinder..	Wrapping	1.7	5.05	4.6						
	2nd Inside....	W.F.	4.35	5.6	3.5	W.B.	17.5	4	do	9.75	6.25
	3rd Outside...	W.F.	4.55	5.6	3.4						
Paget's Rifle Carbine	1st Cylinder..	Wrapping	1.33	5.0	4.73						
	2nd Inside....	W.F.	4.05	4.6	2.5	W.B.	17.5	4	do	9.75	6.25
	3rd Outside...	W.F.	4.4	4.6	2.33						
Carbine (Carbine bore)..		W.F.	4.5	5.25	3.15	W.B.	17.5	4	do	9.75	5.0
Carbine (M.B.) .... Pistol (M.B.)		W.F. W.F.	4.5	7.4	5,25	W.B.	17.5	4	do	9.75	5.0
Pistol (C.B.)		W.F.	4.5	6.35	4.0	W.B.	17.5	4	do	9.75	5.0
Pistol percussion		W.F.	3.75	5.2	3.6	W.B.	14.25	3	do	8.3	5.0

the range 85 to 90 grams (1,312 to 1,388 grains). All the balls were gauged and the number of caps counted. In case the sample packet did not pass, one packet out of 10 of the entire lot had to be examined, and if these did not pass the lot was rejected.

The dragoon musket charge was three-fourths that of the musket. That for the gendarmes was the same. The charge for the cavalry musketoon was one-half that of the musket and that for the pistol one-third. The charges for flintlock arms in the official table which follows include priming. This was one gram (15.4 grains) for muskets, musketoons, and cavalry pistols; 0.35 of a gram (5.4 grains) for the gendarme pistol.

Paper small-arms cartridges made for the United States military service were usually wrapped in bundles of ten. Typical packages are shown on plates 45 and 46. As a rule these were not labeled, the only identification being on the wooden case. Special types, such as blanks or those using Williams' bullets, or cartridges for particular arms, such as the cadet musket or the Sharps carbine, were sometimes wrapped in colored paper for positive recognition. When special types were desired in certain ratios, bundles were made up accordingly. In some cases one buckshot cartridge was wrapped with nine buck-and-ball or with nine ball loads. When the Williams' bullet was adopted, early in the Civil War, one was put in each package of caliber 0.58 ball cartridges. In 1864 this was changed by Ordnance Circulars No. 41 and 47. The latter reads as follows:

Circular No. 47—Series of 1864
RELATIVE TO WILLIAMS' BULLETS

ORDNANCE OFFICE
War Department
Washington, September 19, 1864

Circular No. 41, of 5th August, 1864, which directed that six cartridges, made with Williams' bullets, should be included in every package of ten cartridges for rifle muskets, is hereby revoked.

No more Williams' bullets will be made up into cartridges after the receipt of this circular. Such bullets of that kind as may be on hand will be retained until further orders, but will not be used except in cases of emergency. The cartridges of this kind on hand will be issued, but where they have not been packed, only three will be put in each bundle until those on hand are used up.

A. B. DYER
Brig. General
Chief of Ordnance

The bundles were packed in wooden cases holding 1,000 rounds each. Between 1850 and 1940 these ammunition cases changed little in appearance or construction. They were built for security in storage

TABLE 10.—PRINCIPAL DIMENSIONS OF FRENCH SMALL ARMS AND THEIR AMMUNITION

Designation (Dimensions given in mm. weights in gm.)	Muskets, Smooth bore, Infantry, 1822 flint	Muskets, Smooth bore, Infantry, 1822 conv. 1840 1842	Muskets, Smooth bore, Voltigeur & Marine, 1822 flint	Muskets, Smooth bore, Voltigeur & Marine, 1822 conv. 1840 1842	Muskets, Smooth bore, Voltigeur chambered	Muskets, Smooth bore, Dragoon, 1822 conv.	Muskets, Smooth bore, Dragoon, 1842	Muskets, Rifled, Rampart, 1831 breech-loader	Muskets, Rifled, Rampart, 1840 .... 1842 .... chambered
Bore diameter	17.5	18.0	17.5	18.0	17.5	17.8	18.0	21.8	20.5
Barrel length	1067.2	1067.2	1013.2	1013.2	789	905.3	904.2	1297.5	838
Chamber or tige[1] diameter	.....	.....	.....	.....	15.5	....	....	24 & 10	14.5
Chamber or tige[1] weight	.....	.....	.....	.....	9	....	....	107.5	44
Ball diameter[2]	16.3	16.7	16.3	16.7	16.7	16.7		22.6	20.0
Ball weight	25.6	26.6	25.6	26.6	26.6	26.6		62.5	47.5
Powder charge	10.52	9.00	10.52	9.00	9.00	6.75		8 to 10	6.25
Trapezoid height	140	140	140	140	140	100		135	110[3] 130
Trapezoid long base	120	120	120	120	120	120		155	80 125
Trapezoid short base	60	60	60	60	60	60		75	80 72
Rectangle for packet length	350	350	350	350	350	350		430	520
Rectangle for packet width	180	180	180	180	180	150		180	150
String length	600	600	600	600	600	550		600	550

Designation (Dimensions given in mm. weights in gm.)	Carbines, Rifled, cartridge .... 1842 .... chambered	Carbines, Rifled, 1846 à tige, cardboard	Carbines, Rifled, 1846 à tige, cardboard	Carbines, Rifled, 1846 à tige, paper	Musketoons, Smooth bore, Gend. 1825 conv. 1842	Musketoons, Smooth bore, Cav. 1822 conv. / Lancer 1856 conv.	Musketoons, Rifled Artillery 1829 conv. à tige, cardboard	Musketoons, Rifled Artillery 1829 conv. à tige, cardboard	Musketoons, Rifled Artillery 1829 conv. à tige, paper	Pistols, Smooth bore, Cavalry 1822 conv.	Pistols, Smooth bore, Marine 1837	Pistols, Smooth bore, Gendarme 1822 conv. 1842
Bore diameter	17.5		17.8		17.6	17.8		17.6		17.6	15.2	15.2
Barrel length	846		852.2		743	486.5		586.5		186.5	155.5	116
Chamber or tige[1] diameter	13.5		9		....	....		9		....	....	....
Chamber or tige[1] weight	52		38		....	....		30		....	....	....
Ball diameter[2]	16.7		17.2		16.7	16.7		17.2		16.7	14.7	14.7
Ball weight	26.6		48		26.6	26.6		48		26.6	19.2	19.2
Powder charge	6.25		4.5		6.75	4.5		3		3	2	1.5
Trapezoid height	110[3] 130	82	63	155	100	100	82	63	155	100	70	70
Trapezoid long base	68 125	42	170	150	120	120	42	170	150	120	110	110
Trapezoid short base	62 62	42	145	80	60	60	42	145	80	60	50	50
Rectangle for packet length	420		340		350	350		340		350	350	350
Rectangle for packet width	170		140		150	150		140		150	100	100
String length	550		500		550	450		500		450	400	400

[1] The tige also extends into the breech-plug 10-mm.
[2] Measured between the lands in the case of rifled arms.
[3] The first column gives dimensions for making cartridges with pasted envelopes, the second without paste.

rather than convenience in the field. Confederate practice followed United States Ordnance precedent, but labels were more freely used on the packages (see pl. 47).

The combustible or skin cartridges were packed in various containers designed to protect them from injury (see pls. 46 and 50). Colt and similar revolver ammunition was usually placed in bored-out wooden blocks (pl. 50b, c). Some kinds were simply wrapped in paper (pl. 50d, f); others came in cardboard cartons like pill-boxes (pl. 50e). In any case, the number in a package was usually that required for charging a revolver cylinder.

Cartridges for the single-shot breech-loading carbines and rifles came in packages or boxes containing 7 to 50 rounds. For the repeaters the tendency was to package enough for one loading (seven in the case of the Spencer) or multiples of that number. (See pls. 48 and 49.)

Flints were usually sold in large casks or in barrels about the size of powder barrels; the latter would hold about 7,500 musket, 13,700 rifle, or 14,700 pistol flints. In service they were packed in boxes holding 5,000. These boxes were 24 by 11.5 inches, the depth varying from 3.25 to 8.75 inches according to the type of flint. Packed boxes of musket, rifle, and pistol flints weighed 129, 82, and 55 pounds, respectively.

Flints were packed in dry sand and were stored in a damp cool place.[27] It was considered that a good flint would stand 50 rounds without being unfit for service, though inferior grades might not last for more than 15. One flint was usually issued with each package of 10 cartridges, though at the end of the flintlock period one in 20 had become the standard.[28] In Europe, also, a supply of one for each 20 rounds was considered sufficient.[29]

Percussion caps were packed with small-arms ammunition, in quantities slightly greater than the number of cartridges, to allow for loss or misfires. With 10 musket cartridges there were 12 caps, and with 6 revolver cartridges 8. Caps also came in bulk, in cans containing 100, 250, or 500. For the arms using magazine priming devices, special caps were provided in tubes or tapes of 25 or 50. (See pl. 44.)

Specimens of old ammunition are often seen in museums and in private collections. Usually the only description consists of somewhat vague terms—buck-and-ball cartridge, paper cartridge, Civil War ammunition, and the like. A systematic listing of the various types of United States service ammunition makes it possible to identify

most ordinary specimens with but little trouble. Such a list is presented in Chapter VII.

NOTES

(See Bibliography for full literature citations)

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Chapter VII

CHECK LISTS OF AMMUNITION USED OFFICIALLY

The only extensive listing of United States small-arms ammunition made with official authorization was that compiled in 1876 by Lt. Henry Metcalfe. Part of the Ordnance Department display at the International Exposition held that year in Philadelphia was a large collection of cartridges that had been assembled and mounted at Frankford Arsenal. Even at that time, when much first-hand information was still available and many types were still on hand in Government arsenals, it was evidently impossible to find specimens made before 1845. The catalog of the Frankford Arsenal collection is reproduced herewith, as it contains much information not available from any other source:

INTERNATIONAL EXHIBITION, 1876

Small-Arm Ammunition

No. 1. Cabinet of small-arm ammunition, prepared at Frankford Arsenal, Pennsylvania

FIRST DRAWER

PAPER AMMUNITION, NOT FIXED

Number	Name of Arm	Bore	Powder	Bullet	
				Diameter	Weight
			Grains	*Inch*	*Grains*
1	Round ball for United States musket, 1842	Smooth	110	.69	412
2	Buck and ball for United States musket, 1842	do	110	.69	435
3	Buckshot for United musket, 1842	do	110	.69	300
4	Round ball for United States rifle, 1840	Rifle	75	.54	220
5	Round ball for United States pistol, 1842	do	60	.54	200
6	Round ball for "Savage" belt pistol	do	65	.50	200
7	Blank for musket, &c	do	60	.58	...
8	Elongated ball for United States musket, 1842 (Melford sub cal).	Smooth	110	.69	420
9	Elongated ball for Austrian rifle musket	Rifle	75	.71	685
10	Elongated ball for Belgian, &c, rifle musket	do	70	.70	765
11	Elongated ball for United States rifle musket, 1842	do	80	.69	730
12	do	do	80	.68	640
13	Elongated ball for Springfield rifle musket, 1863	do	60	.58	480
14	Elongated ball for Springfield and Enfield	do	60	.577	495
15	do	do	50	.57	530
16	Elongated ball for Springfield and Enfield, Williams, 1st.	do	65	.57	565
17	Elongated ball for Springfield and Enfield, Williams, 2d.	do	60	.57	465
18	Elongated ball for Springfield and Enfield, English	do	60	.568	530

19	Elongated ball for United States rifle, 1840	do	60	.54	570
20	do	do	60	.52	455
21	Elongated ball for Green B. L. rifle	do	70	.54	410
22	Elongated ball for United States pistol, 1840	do	30	.54	410
23	Elongated ball for United States pistol carbine	do	40	.58	450
24	Elongated ball for Colt's, &c., army revolver	do	25	.44	205
25	Elongated ball for Colt's navy revolver	do	15	.36	150

SECOND DRAWER

PAPER AMMUNITION, FIXED

Number	Name of Arm	Powder	Bullet	
			Diameter	Weight
		Grains	Inch	Grains
26	Merrit's for rifle musket, 1842, &c	60	.69	720
27	Merrit's for musketoon	50	.69	715
28	Merrit's for Springfield rifle musket	50	.58	455
29	Merrit's for Merrit's rifle	50	.56	425
30	Merrit's for Merrit's carbine	40	.56	420
31	Merrit's for Merrit's carbine, United States make	40	.56	420
32	Sharps for Sharps rifle, cal. .54	60	.55	465
33	Sharps for Sharps rifle, cal. .45	70	.47	260
34	Sharps for Sharps rifle, cal. .40	45	.41	170
35	Sharps for Sharps carbine	55	.52	450
36	Colt's for Colt's revolving rifle	45	.56	490
37	Colt's for Colt's revolving pistol carbine	20	.44	260
38	Colt's for Colt's revolver, army	17	.44	260
39	Colt's for Colt's revolver, navy	12	.36	135
40	Savage revolver, navy	10	.36	150
41	Inserted paper for Springfield rifle musket, &c	55	.58	475
42	Hall's rifle	40	.54	395
43	Chadwick's for Mississippi rifle, &c	50	.54	420
44	Gardener's shell for Springfield rifle musket, &c	60	.58	450
45	Rebel inserted paper for Enfield rifle musket, &c	70	.577	500
46	Shaler's three-bullet, for Springfield rifle musket, &c	55	.58	610
	Gun, cotton, paper:			
47	Johnson & Dow's combustible paper for Springfield rifle musket, &c.	60	.58	500
48	Johnson & Dow's combustible paper for Enfield rifle musket	60	.574	480
49	Johnson & Dow's combustible paper for Sharps carbine	50	.52	445
50	Johnson & Dow's combustible paper for army revolver	25	.44	240
51	Johnson & Dow's combustible paper for navy revolver	17	.36	150
52	Linen and paper for Sharps carbine	60	.52	450
53	Linen and paper for Starr's carbine	50	.54	430
54	Linen and paper for Union cartridge	40	.54	390

THIRD DRAWER

TRANSITION, FIXED

Number	Name of Arm	Description	Powder	Bullet	
				Diameter	Weight
			Grains	Inch	Grains
55	Hazard compressed for R. M., 1842	Collodion varnish	70	.69	745
56	Hazard compressed Sp. R. M., &c	do	60	.577	490
57	Hazard compressed Sp. Williams ball	do	60	.57	465
58	Hazard compressed Colt's rifle	do	55	.58	480
59	Hazard compressed United States rifle, 1840	do	70	.54	450
60	Hazard compressed Sharps carbine	do	50	.52	450
61	Hazard compressed army revolver	do	25	.44	210
62	Hazard compressed navy revolver	do	21	.36	140
63	Hayes compressed for rifle	Skin wrapped	60	.54	410
64	Hayes compressed army revolver	do	22	.44	205
65	Hayes compressed navy revolver	do	17	.36	150
66	Hotchkiss compressed for army revolver	do	22	.44	210
67	Hotchkiss compressed for navy revolver	do	17	.36	150
68	Hotchkiss compressed Requa battery	do	65	.54	390

69	Hotchkiss compressed Savage navy revolver	do	10	.36	150
70	Bartholow's compressed for S. B. musket, 1842	Silk and shellac	65	.69	500
71	Bartholow's compressed R. musket, 1842..	do	70	.69	750
72	Bartholow's compressed Sp. R. musket....	do	65	.58	490
73	Bartholow's compressed army revolver.....	do	20	.44	260
74	Bartholow's compressed navy revolver.....	do	14	.36	140
75	Smith's rubber for Smith's carbine.......	Rubber case	40	.50	380
76	Poultney's foil for Smith's carbine........	Foil inside of paper	40	.50	380
77	Poultney's foil for Smith's carbine........	do	40	.50	380
78	Poultney's foil for Smith's carbine, small chamber	do	40	.50	380
79	Poultney's foil for Burnside carbine......	do	40	.54	370
80	Poultney's foil for Maynard's carbine....	do	40	.50	330
81	Poultney's foil for Gallagher's rifle and carbine	do	60	.50	440
82	Soldered foil, Gallagher's carbine.........	Foil soldered	60	.50	410
83	Jackson's tin, &c., Gallagher's carbine....	Paper-over-tin	55	.50	430
84	Gallagher's brass, Gallagher's carbine.....	Brass, lined with paper	60	.50	435
85	Gallagher's brass, Gallagher's carbine.....	Brass	60	.50	435
86	Burnside for Burnside carbine...........	do	48	.54	380
87	Maynard for Maynard carbine...........	do	40	.50	340
88	Berdan, sporting, 1865..................	Paper, brass base	..	.55	...
89	Gun-cotton, Austrian	Woven on stick	26	.58	526
90	Gun-cotton, Austrian, with button........	do	20	.53	410
91	Barlow gun-cotton paper.................	Charge, rolled paper	40	.57	540

FOURTH DRAWER

RIM PRIMED AND MISCELLANEOUS

SECTION I.—CALIBER, ".50, SERVICE MUSKET SIZE

No.	Description
92	Poultney (Crispin) foil. Brass foil with iron base, and separate brass pocket inserted, clinching the reinforcing wad. Ord. Mem. No. 14, plate xlviii.
93	Poultney (Crispin) foil. Zinc foil, with iron base and separate brass pocket inserted, not clinching the reinforcing wad.
94	Poultney (Crispin) foil. Brass foil with brass base in one piece with the pocket, which is impressed.
95	Hotchkiss solid head. Pocket like Martin, but pressed up from solid base, inclosing small anvil of various patterns. Ord. Mem. No. 14, plate liv.
96	Hotchkiss solid head reloader. Pocket and Berdan return anvil pressed up from solid base.
97	Remington (Martin base). Service as made by Remington in 1872 for use in his arm on trial in the field. F. A. Am. No. 173.
98	Remington, 1874. Reinforcing cap on ring of binders board around pocket. F. A. Am. No. 337.
99	Winchester (Milbank primer). Thick-folded flange. The primer is a flanged percussion cap inserted in a pocket without anvil. F. A. Am. No. 291. Reported on April 29, 1873. Ord. Mem. No. 14, plate xxxv.
100	United States Cartridge Company. Solid head inside primed. Priming in an inside pocket pressed up from the solid metal of the base, the walls of the pocket subsequently closed down upon the priming forming the anvil; cast bullet. F. A. Am. No. 106. Reported on August 8, 1870. Ord. Mem. No. 14, plate lvi.
101	United States Cartridge Company. Solid head outside primed as priming in a closed copper capsule inserted in a shallow outside pocket without anvil. F. A. Am. No. 281. Reported on January 8 and February 4, 1873. Ord. Mem. No. 14, plate lix.
102	United States Cartridge Company. Solid head outside primed as furnished on order for 2,000,000 of November 24, 1873, differs from last in the base being convex and thicker, and the bullet longer and more deeply cannelured. Priming capsules perforated with two vents. F. A. Am. No. 388. Reported on (inspection) January 7, 1874, *et seq.*
103	Union Cartridge Company (Martin base). F. A. Am. No. 174. Tested November 2, 1871.
104	Berdan, early form. Brass case, folded flange, shallow outside pocket. The burr of the vent forming the anvil. Date unknown.
105	Union Cartridge Company (Berdan), as furnished on order for 2,500,000, of April 2, and November 24, 1873. Reinforce ring and return nipple anvil of the Berdan system. F. A. Am. No. 296. Reported on (inspection) August 4, 1873, *et seq.*

SECTION II.—MISCELLANEOUS CENTER PRIMED MUSKET AND CARBINE CARTRIDGES

106	Berdan. Early form for ".57 caliber. Inserted outside pocket containing a disk-shaped capsule of priming and side teat; patented 1866. Ord. Mem. No. 14, plate xxxix C.

107 Berdan. Early form for ".57 caliber. Impressed shallow outside pocket and cap. The burr of the vent forming the anvil made after seeing the impressed pocket of "Benet" cartridge at Frankford Arsenal.

108 Berdan. Early form for ".44 caliber. Impressed shallow cup, closed with primed disk, the burr of the vent forming the anvil (1867).

109 Berdan, as made by the Union Cartridge Company, for Russian Government ".42 caliber; charge, 77 grains; bullet, 375 grains. Brass bottle-shaped case, re-enforcing ring, and return anvil pocket F. A. Am. No. 40 and 159. Reported on (Small-arms, class 6), January 4, February 2, and February 22, 1870, also tested by Small-Arms Caliber Board as No. 32 of their report. Ord. Mem. No. 14, plate xxxix X.

110 Berdan, as made by the Union Cartridge Company for Ward-Burton, ".45 caliber; charge, 85 grains; bullet, 400 grains. Berdan base and priming. F. A. Am. No. 175. Reported on (gun and ammunition) by Board at Frankford Arsenal, November 27, 1871.

111 Berdan, as made by Union Cartridge Company for Ernest's ".45 caliber rifle; charge, 52 grains; bullet, 290 grains. F. A. Am. No. 211. Rifle failed utterly; no report.

112 Mead's explosive bullet cartridge, ".50 caliber. General service dimensions. Berdan case. Charge stated to be 70 grains. Bullet with copper capsules in front. Fired in Gatling gun 1874. Mead's patent, December 10, 1872. F. A. Am. No. 345.

113 Remington make, cup anvil for navy carbine, model 1868. Thin tin cap vents not retinned. Cast bullet confused with Frankford Arsenal ammunition (No. 451) for same arm. F. A. Am. No. 125. Reported on November 15, 1870.

114 United States Cartridge Company. Solid head front lubricant as proposed to be made for the navy like their army cartridge in all respects except length of case (2.35 inches). Space in front of bullet filled with lubricant. F. A. Am. No. 286. Tested April 11, 1873. Ord. Mem. No. 14, plate lx.

115 Winchester solid head, ".45 caliber, bottle-shaped, very thick, solid base and flange, outside pocket and cap with cruciform anvil, 1874. F. A. Am. No. 339.

116 Morse's arch anvil, made for navy, 1860. Patented 1858. Ord. Mem. No. 14, plate i.

117 Bolt anvil, unknown, cap perforating an India-rubber base like Morse's.

118 Williams rifle, center-fire, disk anvil, crimped into flange; Williams bullet.

119 Covered pocket paper case with metallic base and outside pocket for cap and anvil, the cap and entire base protected by a metallic cover that forms the flange.

Section III.—Rim-fire Musket and Carbine Cartridges, various makes. Illustrative

No.	Description
120	".58 caliber for Allen alteration of Springfield rifle musket, straight case, rim-fire; charge 60 grains musket powder. Bullet, 500 grains, made at National Armory, 1865.
121	".50 caliber, straight case, rim fire; charge 60 grains musket powder; bullet, 400 grains. Made at National Armory 1865.
122	".50 caliber, bottle-shaped case, rim fire; case .58 inch diameter, charge 65 grains; bullet, 480 grains. Made at National Armory, May 1866. Experimental.
123	".45 caliber, straight case, rim fire; case .50 inch diameter, charge 65 grains; bullet, 480 grains. Made at National Armory, May, 1866. Colonel Laidley's Experimental.
124	".45 caliber, bottle-shaped case, rim fire; case .54 inch diameter, charge 70 grains; bullet, 480 grains. Made at National Armory, May, 1866. Colonel Laidley's Experimental.
125	".44 caliber, straight case, rim fire; charge, 45 grains; bullet, 500 grains. Made at National Armory, 1865-'66. Colonel Laidley's Experimental No. 2.
126	".44 caliber, bottle-shaped case, rim fire; charge, 45 grains; bullet, 350 grains. Made at National Armory, 1865-'66. Colonel Laidley's Experimental No. 4.
127	".44 caliber, bottle-shaped case, rim fire; charge, 40 grains; bullet, 300 grains. Made at National Armory, 1865-'66. Colonel Laidley's Experimental No. 5.
128	".44 caliber, bottle-shaped case, rim fire; charge, 40 grains; bullet, 350 grains. Made at National Armory, 1865-'66. Colonel Laidley's Experimental No. 6.
129	".44 caliber, bottle-shaped case, rim fire; charge, 40 grains; bullet, 300 grains. Made at National Armory, 1865-'66. Colonel Laidley's Experimental No. 6 *bis*.
130	".50 caliber, straight case, rim fire; charge, 55 grains; bullet, 500 grains. Made at National Armory, 1865-'66. Colonel Laidley's Experimental No. 8.
131	Spencer carbine, as made at Frankford Arsenal, 1865-'66; charge, 40 grains; bullet, 450 grains. Ord. Mem. No. 14, plate iv.
132	Spencer carbine, as made by Leet & Co., 1865; charge, 40 grains; bullet, 395 grains. F. A. Am. No. 99. Tested April 14, 1870.
133	Spencer carbine, &c., as made by Smith & Wesson, 1865, for various arms; charge, 40 grains; bullet, 440 grains.
134	Sharp & Hankins carbine by Leet & Co., 1865; charge, 55 grains; bullet, 460 grains.
135	Ballard's carbine, &c., caliber ".44, as made by Smith & Wesson, for various small caliber carbines, 1865; charge, 25 grains; bullet, 205 grains.
136	Henry carbine, caliber ".44, as made by Henry Rifle Company, 1864; charge, 30 grains; bullet, 210 grains.

SECTION IV.—PISTOL CARTRIDGES BY VARIOUS MAKERS

137 Inside cap bolt anvil, single arch, ".44 caliber.
138 Inside cap bolt anvil, double arch, ".44 caliber.
139 Outside cap, solid base, ".44 caliber.
140 Outside cap, center flanged, ".36 caliber.
141 Outside cap, front flanged ".30 caliber, front lubricant.
142 Outside cap, square case, ".36 caliber, nipple exposed.
143 Teat primed, ".44 caliber, spheroidal base; cylindrical teat; front flanged; front lubricant.
144 Teat primed, ".36 caliber, spheroidal base; flattened teat; front flanged; front lubricant; made by National Arms Company, New York, 1860. Ord. Mem. No. 14, plate lxiii, fig. 3.
145 Teat primed, ".36 caliber; flat base; flattened teat; front flanged; front lubricant.
146 Rim primed, ".40 caliber; without flange; concave base; front lubricant. Ord. Mem. No. 14, plate lxii, fig. 5.
147 Rim primed, ".30 caliber; front flanged; concave base; front lubricant.
148 Rim primed, ".24 caliber; without flange; solid base; front lubricant; Ord. Mem. No. 14, plate lxii, fig. 6.
149 Rim primed, ".30 caliber; center flanged; spheroidal frustum base.

No. Description
150 English Boxer Snyder, caliber ".57; parts and stages of manufactures, showing sealed front cavity in bullet, &c.
151 English Boxer Snyder, caliber ".50; paper and foil.
152 English Boxer Henry, caliber ".45; long case, foil and paper.
153 English Boxer Henry, caliber ".45; long case, foil only.
154 English Boxer Henry, caliber ".45; bottle-shaped case; foil powder, 85 grains; musket bullet hardened, 484 grains. F. A. Am. No. 275, used by Small-Arms Caliber Board 1872. No. 51 of their Report. Ord. Mem. No. 14, plate xlix.
155 English Boxer Henry, caliber ".45; bottle-shaped case; foil shortened as made by Eley. F. A. Am. No. 285.
156 French chassepot, paper; caliber *circa* ".45; powder, 74 grains; rifle-bullet, lead, 388 grains. F. A. Am. No. 332.
157 French mitrailleuse, pasteboard, with metal base; caliber *circa* ".50; powder, 180 grains; compressed in 6 short cylinders; bullet, lead, 750 grains. F. A. Am. No. 333.
158 Prussian needle gun, paper; cylinder choked in front of bullet; powder, 74 grains; rifle bullet, egg-shaped, 325 grains, in sabot; primed on base. F. A. Am. No. 282.
159 Prussian needle gun; explosive bullet substantially like above, but bullet charged and explosible by blow from front; powder, 70 grains; rifle bullet, 431 grains, charged. F. A. Am. No. 330.
160 Prussian new metallic; solid base flange in advance of bottom powder. Bullet, patched, 438 grains, F. A. Am. No. 331.
161 Russian, made in Russia; phosphor-bronze case; Berdan's return pocket anvil; powder, *circa* 80 grains; musket bullet circa, 375 grains, patched. Lubricant at first a disk on base.
162 Russian, made in United States, by Union Cartridge Company, of Bridgeport, Conn. Brass, caliber, ".42; bullet, lead, 373 grains, patched; powder, musket, 77 grains. Lubricant disk on base and dipped. F. A. Am. Nos. 40 and 159. Reported on January 4 and February 2 and 22, 1870.
163 Austrian "Werndl," copper annular anvil in outside pocket; caliber, *circa* ".42; powder, *circa* 65 grains; musket bullet, cast-lead, 318 grains. F. A. Am. No. 277. Fired by Small-Arms Caliber Board 1872, and No. 53 of their report.
164 Dutch Beaumont rifle musket, caliber ".45; brass solid head, pocket cap and anvil priming; anvil with case to push out the old cap in reloading; powder, 68 grains; musket bullet, 337 grains. F. A. Am. No. 247. Fired Small-Arms Caliber Board 1872, No. 31 of their report. Ord. Mem. No. 14, plate lvii.
165 Dutch carbine, caliber ".45; brass, folded head with re-enforcing ring; priming like last; powder, 50 grains; musket bullet, 337 grains. F. A. Am. No. 248. Ord. Mem. No. 14, plate lviii.
166 Swiss "Vetterlin," ".41 caliber; case copper, rim primed; powder, 60 grains; musket bullet cast lead, 312 grains. F. A. Am. No. 276. Fired by Small-Arms Caliber Board 1872, No. 52 of their report.
167 Berdan sporting, for shot; return pocket anvil, priming brass. Made by United States Cartridge Company.
168 Eley sporting, for shot; pocket and anvil cap primed; pasteboard, with metal base No. 12.
169 Eley sporting, for shot; pocket and anvil cap primed; pasteboard, with metal base No. 20.
170 Eley sporting, for shot; Lefaucheux priming; pasteboard, with metal base No. 10.
171 Leet sporting, for shot; pocket and anvil cap primed; pasteboard, re-enforced with foil near metallic base.
174 Lefaucheux pistol cartridges, 3 calibers.

As drawer 6 contained only variations in amount and make of powder, items 175 to 244 inclusive are omitted.

SEVENTH DRAWER

MODIFICATION IN BULLET AND LUBRICANT

[C. F. metallic, caliber ".50]

No.	Description
245	Bullet used in most bar anvil ammunition and up to 1868. F. A. Am. No. 58.
246	Experimental bullet with cannelures deepened to .04 inch to hold more lubricant, 1867. F. A. Ball No. 59.
247	Experimental bullet with cannelures deepened to .045 inch to hold more lubricant, 1867. F. A. Ball No 60.
248	Bullet determined by Lieutenant Stockton's experiments and used in service from March, 1868, to July, 1870. F. A. Am. No. 1.
249	Experimental, a disk of lubricant with wad under the bullet *added to* the usual lubrication in the cannelures. F. A. Am. No. 73.
250	Experimental, a disk of lubricant with wad under the bullet *substituted for* the usual lubrication in the cannelures. F. A. Am. No. 14.
251	Experimental front lubrication case, projecting on the front of bullet, space filled up with lubricant in addition to that in the cannelures. F. A. Am. No. 20. Ord. Mem. No. 14, plate lxi.
252	Experimental star patch of bank-note paper, covering the base and cylindrical surface of the bullet; lubricant in cannelures. F. A. Am. No. 2.
253	Experimental star patch of bank-note paper, covering the base and cylindrical surface of the bullet and inclosing a disk of lubricant on the base of the bullet in addition to that in the cannelures. F. A. Am. No. 3.
254	Experimental star patch of bank-note paper, covering the base and cylindrical surface of the bullet; a disk of lubricant in paper capsule applied to the base of the bullet *outside* of the patch, F. A. Am. No. 4.
255	Experimental wrapped patch of bank-note paper, covering the cylindrical portion of the bullet and folded down on the base lubrication in cannelures. F. A. Am. No. 5.
256	Experimental wrapped patch of bank-note paper, covering the cylindrical portion of the bullet and folded down on a disk of lubricant applied to the base in addition to that in the cannelures. F. A. Am. No. 6.
257	Experimental wrapped patch of bank-note paper, covering the cylindrical portion of the bullet and folded down on the base; a disk of lubricant on base outside of patch. F. A. Am. No. 7.
258	Experimental; the diameter of the bullet reduced by .005 inch. F. A. Am. No. 24.
259	Experimental; the bullet hardened by addition of one-twelfth tin. F. A. Am. No. 21.
260	Experimental bullet, smooth, with lubricant in disk on base; wrapped patch. F. A. Am. No. 12.
261	Experimental bullet, smooth ellipsoidal front, with lubricant in disk on base; wrapped patch. F. A. Am. No. 203.
262	Experimental bullet, smooth, hardened with one-twelfth tin, patched and lubricated with disk of wax and wads like the earlier Martini Henry. F. A. Am. No. 15.
263	Experimental bullet, with two broad cannelures (Benét) instead of three ordinary ones. F. A. Am. No. 61.
264	Experimental bullet, with two broad cannelures (Benét) like last, but lightened 40 grains by cavity in base. F. A. Ball No. 62.
265	Experimental bullet, with two broad cannelures (Benét), lengthened to 2½ calibers; weight preserved at 450 grains by cavity in base. F. A. Am. No. 18.
266	Experimental bullet, with two broad cannelures (Benét) like last, but hardened with one-twelfth tin. F. A. Am. No. 19.
267	Experimental bullet, with two broad cannelures (Benét), lengthened to 2¼ calibers; weight preserved at 450 grains by cavity in base. F. A. Am. No. 23.
268	Experimental bullet, with two broad cannelures (Benét) like last, but hardened with one-twelfth tin. F. A. Am. No. 27.
269	Experimental bullet, with two broad cannelures (Benét), lengthened to 2¼ calibers; diameter reduced by .01 inch; weight preserved at 450 grains by cavity in base. F. A. Am. No. 28.
270	Experimental bullet, with two broad cannelures (Benét) like last, but hardened with one-twelfth tin. F. A. Am. No. 29.
271	Experimental sectional bullet (Farley); front of bullet doweled into rear; lubricant between sections. F. A. Am. No. 16.
272	Experimental sectional bullet; (Farley); rear of bullet doweled in front; lubricant between sections. F. A. Am. No. 17.
273	Experimental bullet; a conoidal frustum on a reduced conical frustum, flushed with lubricant. F. A. Am. No. 25.
274	Experimental bullet; a conoidal frustum on a reduced conical frustum, 1.1 inches long, flushed with lubricant. F. A. Am. Nos. 104 and 105.
275	Experimental bullet; imitation of Swiss "Federal" bullet; weight same as service lubrication in cannelures. F. A. Am. No. 26.
276	Service bullet resembling that of service ammunition, but diameter in front of front cannelure made equal to the general diameter, the reduction to be effected by the crimping of the case. Used in service ammunition from July 21, 1870. F. A. Am. No. 111.

277 Experimental, Robert's bullet; blunt ellipsoidal front, broad shallow cannelure, and cavity in the base; lubrication in cannelure. F. A. Am. No. 66.
278 Experimental; Dimmick's bullet No. 1; frustum of a conoid on frustum of a cone. F. A. Am. No. 126.
279 Experimental, Dimmick's bullet No. 2; frustum of a cone on a cylinder; two cannelures. F. A. Am. Nos. 134 and 135.
280 Experimental, Dimmick's bullet No. 3; frustum of cone on a cylinder; two cannelures; shallow-dished cavity in base. F. A. Am. No. 138.
281 Experimental, Week's bullet No. 1; conoidal frustum on cylinder; three bearing rings; lubrication by greased patch wrapped. F. A. Am. No. 157.
282 Experimental, Week's bullet No. 2; conoidal frustum on cylinder; two bearing rings; lubrication by circular greased patch. F. A. Am. No. 158.
283 Experimental, Week's bullet; smooth conoidal frustum on cylinder; lubrication by circular greased patch. F. A. Am. No. 160.
284 Experimental carbine, reduced from rifle musket, 450 grains to 430 grains, by conical cavity in base. F. A. Am. No. 177.
285 Experimental carbine, reduced from rifle musket, 450 grains to 415 grains, by conical cavity in base. Fired with various charges. F. A. Am. Nos. 178, 181, and 186.
286 Experimental carbine, reduced from rifle musket, 450 grains to 400 grains, by conical cavity in base. Fired with various charges. F. A. Am. Nos. 179, 182, and 187.
287 Experimental carbine, reduced from rifle musket, 450 grains to 385 grains, by conical cavity in base. Fired with various charges. F. A. Am. Nos. 180, 183, and 188.
288 Experimental carbine, reduced from rifle musket, 450 grains to 415 grains, by making the front ellipsoidal. Fired with two different charges. F. A. Am. Nos. 190 and 192.
289 Experimental carbine, reduced from rifle musket, 450 grams to 430 grains, by making the front ellipsoidal. Fired with two different charges. F. A. Am. Nos. 189 and 191. The latter with 55-grain charge was adopted as service carbine cartridge 1872.
290 Experimental, Hubbell's adaptation of the Prussian needle-gun bullet and sabot to metallic case. Fired with slight modifications in three forms. F. A. Am. Nos. 244, 245, and 246.
291 Experimental, gas-check bullet; substantially like service ".50 caliber, but made to lap outside the mouth of case. F. A. Am. No. 287.
292 to 310 Vacant.

EIGHTH DRAWER

DISK AND BAR ANVILS

No. Description

311 Center swell base copper disk anvil; two vents; short case; charge, 40 grains; bullet, 450 grains. Frankford Arsenal, 1865; experimental. Ord. Mem. No. 14, plate v.
312 Iron disk anvil, chamfered and crimped into flange; slot vent. Springfield, 1867.
313 Broad bar anvil, iron chamfered and crimped into flange; slot vent. Springfield, 1867.
314 Martin straight bar re-enforced; tinned iron with re-enforced copper cup held in by indents. Springfield, 1867. Ord. Mem. No. 14, plate xiii.
315 Martin straight bar; tinned iron held by indents, as made for service at Frankford Arsenal, from October, 1866, to March, 1868. F. A. Am. No. 133. Ord. Mem. No. 14, plate x.
316 Copper bar anvil; chamfered ends held by re-entrant fold. Springfield, 1870. Record No. 115.
317 Copper disk anvil, plain square edge, held in by indents. Frankford Arsenal, August, 1871. Ord. Mem. No. 14, plate xxxi A.
318 Copper disk anvil in re-enforcing cup, both held by indents. Frankford Arsenal, February, 1872. Ord. Mem. No. 14, plate xl. Record No. —.
319 Copper disk anvil; chamfered, held in by re-entrant fold. Frankford Arsenal. October, 1871. Ord. Mem. No. 14, plate xxxi D. Record No. 199.
320 Copper disk anvil, expanding, held in by indents; has re-entrant fold underneath. Ord. Mem. No. 14, plate xxxi C. Frankford Arsenal, 1871. Record No. 197.
321 Copper disk anvil, expanding, held in by knurl all around; has fold underneath. Frankford Arsenal, October, 1871. Record No. 201.
322 Copper disk anvil, corrugated, held in by knurl all around; case with corrugated base. Frankford Arsenal, 1871. Ord. Mem. No. 14, plate xxxii. Record No. —.
323 Covered base anvil, primed outside of base, priming covered by a flat cap embracing flange. Frankford Arsenal, February, 1872. Record No. —.
324 Needle or disk and bolt anvil, priming; in case of bullet; disk held in by flange and supporting axial bolt extending almost to priming; bolt pointed like a firing-pin. Frankford Arsenal, for Lieutenant Corliss. Reported on February 16, 1871. Ord. Mem. No. 14, plate xxxiii. Record No. 136.
325 Needle or disk and bolt anvil, like last, but bolt squared in front like a winding arbor. Frankford Arsenal. Record No. 137.
326 Martin pocket short-bar anvil, held in by re-entrant folded pocket; flange re-enforced by ring inside (original Martin). Springfield. F. A. Am. No. 202. Ord. Mem. No. 14, plate xliii.

327 Martin pocket, without re-enforcing ring, anvil tin or copper. Springfield Armory, 1869. F. A. Am. No. 118. Ord. Mem. No. 14, plate xx.
328 Martin pocket in brass. Springfield, 1869. F. A. Am. No. 117.
329 Martin pocket with re-entrant fold above flange. Springfield, 1870. F. A. Am. No. 113.
330 Martin pocket with re-entrant fold and double, and double indented anvil made for service at Frankford Arsenal, November and December, 1871. F. A. Am. No. 176. Ord. Mem. No. 15, plate xxii.
331 Martin pocket, re-enforced with solder in flange. Frankford Arsenal, 1872. Record No. —.
332 Martin pocket, closed down without anvil. Frankford Arsenal, 1873. Record No. —.

CAP PRIMED CASES

333 Vacant.
334 Vacant.
335 Benét narrow pocket saddle anvil in small cap, short case; bullet No. 57. Frankford Arsenal, 1866.
336 Benét wide-pocket saddle anvil in large cap, short case; bullet No. 57. Frankford Arsenal, 1866.
337 Solid nipple head; iron nipple in pocket in solid brass base of case; short case. Frankford Arsenal, 1865, record No. —.
338 Crispin foil and papers pocket pressed in brass cup attached to base of foil and paper case; different thicknesses of foil tried. Frankford Arsenal, 1867. Ord. Mem. No. 14, plate xvii.
339 Laidley arch anvil; inside cap iron anvil reaching to bullet. Springfield, 1865. Ord. Mem. No. 14, plate vii.
340 Laidley capped bar; inside cap on an arched bar held in by indents. Springfield, 1866. Ord. Mem. No. 14, plate viii.
341 Star cap-receiver; inside cap and anvil, contained in a star-shaped pocketed receiving plate. Frankford Arsenal, 1866. Ord. Mem. No. 14, plate vi.
342 Cup-cap receiver; inside cap and anvil, contained in a pocket of re-enforcing cup at bottom of case. Frankford Arsenal, February, 1872. Ord. Mem. No. 14, plate xlix.
343 Re-enforced pocket case; re-enforcing ring clinched in by pressing back the pocket outside cap spear-head anvil. Frankford Arsenal, 1872. Ord. Mem. No. 14, plate xxxviii A; record No. —.
344 Plate flanged; brass base plate, held on by a separate clinched pocket; on side cap and spear-head anvil. Frankford Arsenal, 1872. Ord. Mem. No. 14, plate xlii.
345 Plate flanged; brass base plate, held on by a solid inside pocket; clinched outside; outside cap and spear head anvil. Frankford Arsenal, January, 1872. Record No. —.
346 Wrapped metal; soldered into pocketed base cup; outside cap and spear-head anvil. Frankford Arsenal, January, 1872. Ord. Mem. No. 14, plate I.
347 Front ignition; wrapped metal, soldered into base cap, with pocket reaching nearly to bullet; outside cap and bolt anvil. Frankford Arsenal. 1872. Record No. 292.
348 Front ignition case pocketed, for cap and spear-head anvil; the pocket prolonged in a small tube nearly to the bullet. Frankford Arsenal, 1872. Ord. Mem. No. 14, plate xxxiv.
349 Treadwell cube anvil; case re-enforced with inside ring, pocketed for outside cap containing cubical anvil. Frankford Arsenal, 1872. Ord. Mem. No. 14, plate xxxviii B.
350 Treadwell cube anvil case, re-enforced, with solder pocketed for outside cap, containing cubical anvil.
351 Treadwell spherical anvil case, re-enforced, with solder in flange, pocketed for outside cap containing spherical anvil. Frankford Arsenal, 1872. Ord. Mem. No. 14, plate xliv.
352 Cast base, wrapped metal, with soft metal base, cast on, pocketed for outside cap and circular anvil. Frankford Arsenal, February, 1872. Ord. Mem. No. 15, plate lii.
353 Berdan base; base of case pocketed and re-enforced in Berdan style, with his return pocket, anvil, and caps. Frankford Arsenal, 1872. Record No. —.
354 Berdan anvil, wrapped metal; base cup pocketed, with Berdan return anvil, re-enforcing ring replaced by the wrapped metal and solder. Frankford Arsenal, 1872. Record No. 251.

CUP ANVILS

355 Tinned cup anvil; straight case; tinned cup held in by the crimps or indents. Frankford Arsenal. Service from March, 1868, to September, 1869. F. A. Am. No. 1.
356 Tinned cup anvil; cylindrical-throated case; tinned cup held in by two crimps or indents. Frankford Arsenal. Service from September, 1869, to August, 1870. F. A. Am. No. 11. Ord. Mem. No. 14, plate xiv.
357 Side vent cup anvil; cup without vent holes, but with sides; flutes leading from priming held in by indents. Frankford Arsenal, 1868.
358 Copper cup anvil; copper cup substituted for tin, held in by two crimps or indents, Frankford Arsenal. Service from August, 1870, to November, 1871. Record No. 112.
358 *bis* Cups for last of various vents and material; experimental. Frankford Arsenal, December, 1870 Record No. 127.
359 Corrugated base copper cup anvil; annular depression near edge of base. Springfield and Frankford, October, 1870. F. A. Am. No. 118½. Ord. Mem. No. 14, plate xxvii.
360 Double crimped copper cup anvil; crimp in front of cup extended all around. Frankford Arsenal, October, 1870. Record No. 119.

361 Corrugated base and double crimp, combining the peculiarities of the last two. Frankford Arsenal, October, 1870. Record No. 170.
362 Corrugated base with knurl instead of crimp in front of cup. Springfield and Frankford, November, 1870. Record No. 121.
363 Reduced case copper cup anvil; held in by reducing the diameter of the whole case in front of it by .02 inch. Frankford Arsenal, December, 1870. F. A. Am. No. 128. Ord. Mem. No. 14, plate xxix.
364 Reduced case copper cup anvil; held in by reducing the diameter of the whole case in front of it by .01 inch. Frankford Arsenal, January, 1871. Record No. 132.
365 Shallow cup; copper cup reduced in depth by .05 inch. Frankford Arsenal. Service from December, 1871. Record No. 184.
366 Solder re-enforce to copper cup anvil; solder run into flange; annular corrugation in base to make a trough for it. Frankford Arsenal, January, 1872. Record No. —.
367 Martin re-entrant fold, with copper cup anvil, and their re-enforcing cup between anvil and case. Springfield, January, 1872. Record No. 200.
368 Solid head copper cup anvil. Frankford Arsenal, 1868. Record No. 170. Ord. Mem. No. 14, plate lv.
369 Double case copper cup anvil, reaching to base of bullet. Frankford Arsenal, January, 1872. Ord. Mem. No. 14, plate xxx.
370 Cone cup anvil; re-enforcing ring inside of flange. Frankford Arsenal, January, 1872. Ord. Mem. No. 14, plate xxxvi A. Record No. —.
371 Cone cup anvil; re-enforcing cup and perforated base. Frankford Arsenal, January, 1872. Ord. Mem. No. 14, plate xxxvii.
372 Outside cup case itself the anvil; priming inside covered by a flanged cup. Frankford Arsenal, 1872. Record No. —.
373 Concave base copper cup held against a concave base; base to yield in firing. Frankford Arsenal, June, 1872. Ord. Mem. No. 14, plate xxviii.
374 Treadwell open base; double cup as made for ".45 caliber. Frankford Arsenal, 1873. Record No. 301.
375 Moore's collar flange; plain unflanged case inclosed in a flanged collar. Frankford Arsenal, 1874. Record No. 349.
376 Solid head Berdan teat anvil; priming for ".45 caliber, rifle; brass case. Made at Frankford Arsenal, July, 1874. Record No. 346.
377 Vacant.
378 Remington B. L. pistol; cup anvil; caliber ".50.
379 Remington B. L. pistol, Martin pocket; caliber ".50.
380 Colt's revolver, Martin pocket; caliber ".44.
381 Smith & Wesson revolver; Martin pocket; caliber ".44.
382 Colt's revolver, Franklin's front extraction cap anvil; caliber ".44. Frankford Arsenal, November, 1868. Ord. Mem. No. 14, plate xviii.
383 Colt's Navy, cup anvil.

NINTH DRAWER

MODIFICATIONS IN CALIBER.—REDUCTIONS

[".45 caliber]

No. Description
384 Bottle-shaped case, 80-grain charge, 400-grain bullet, cannelured; length of cartridge, 2.6 inches. F. A. Am. No. 148. Reported on January 6, 1872.
385 Bottle-shaped case, 75-grain charge, 400-grain bullet, cannelured; length of cartridge, 2.5 inches. F. A. Am. No. 149. Reported on January 6, 1872.
386 Bottle-shaped case, 70-grain charge, 400-grain bullet, cannelured; length of cartridge, 2.4 inches F. A. Am. No. 150. Reported on January 6, 1872.
387 Bottle-shaped case, 80-grain charge, 420-grain bullet, cannelured; length of cartridge, 2.6 inches. F. A. Am. No. 151. Reported on January 6, 1872.
388 Bottle-shaped case, 75-grain charge, 420-grain bullet, cannelured; length of cartridge, 2.5 inches. F. A. Am. No. 152. Reported on January 6, 1872.
389 Bottle-shaped case, 70-grain charge, 420-grain bullet, cannelured; length of cartridge, 2.4 inches. F. A. Am. No. 153. Reported on January 6, 1872.
390 Bottle-shaped case, 80-grain charge, 440-grain bullet, cannelured; length of cartridge, 2.6 inches. F. A. Am. No. 154. Reported on January 6, 1872.
391 Bottle-shaped case, 75-grain charge, 440-grain bullet, cannelured; length of cartridge, 2.5 inches. F. A. Am. No. 155. Reported on January 6 and June 21, 1872.
392 Bottle-shaped case, 70-grain charge, 440-grain bullet, cannelured; length of cartridge, 2.4 inches. F. A. Am. No. 156. Reported on January 6, 1872.
393 Bottle-shaped case, 80-grain charge, 425-grain bullet, smooth-patched and dipped; inserted .4 inch. F. A. Am. No. 204.
394 Bottle-shaped case, 75-grain charge, 425-grain bullet, smooth-patched and dipped; inserted .5 inch. F. A. Am. No. 205. Reported on June 21, 1872.

395 Martini-Henry imitation, Martin base, with re-enforce ring, hardened bullet; patch and wad to resemble Henry ammunition made at Springfield Armory, and reported on from there.

396 Sectional bullet, hardened front; lead base to drive up the Schenkle sabot. F. A. Am. No. 289. Failed entirely.

397 Bottle-shaped case, short lap, 75-grain charge, 440-grain bullet, cannelured; inserted .2 inch. Lubrication base wad and dipped. F. A. Am. No. 217. Reported on June 21, 1872. No. 26 of report of Small-Arms Caliber Board.

398 Bottle-shaped case, short lap, 75-grain charge, 425-grain bullet, smooth; inserted .15 inch; lubrication base wad and dipped. F. A. Am. No. 218. Reported on June 21, 1872. No. 28 of report of Small-Arms Caliber Board.

399 Bottle-shaped case, short lap, 75-grain charge, long Laidley bullet, 485 grains, cannelured; inserted .15 inch; lubrication base wad and dipped. F. A. Am. No. 219. No. 29 of report of Small-Arms Caliber Board.

400 Bottle-shaped case, long lap, same as last, but lap of case on bullet increased from .15 inch to .45 inch. F. A. Am. No. 220. No. 30 of report of Small-Arms Caliber Board.

401 Vacant.

402 Vacant.

403 Straight case, charges 60, 70, 75, and 80 grains; bullet, 400 grains; four cannelures, one exposed; length, 2.78 inches; same for all charges. F. A. Am. Nos. 258 to 262, inclusive. Made at Springfield Armory for Small-Arms Caliber Board, and represents Nos. 39 to 43, inclusive, of its report.

404 Straight case, charge 70 grains; bullet, 400 grains; four cannelures; all covered; length, 2.68 inches. F. A. Am. No. 266. Made at Springfield Armory for Small-Arms Caliber Board, and No. 47 of its report.

405 Straight case; same as last, but case shortened .18 inch, making length 2.5 inches. F. A. Am. No. 269. No. 50 of Small-Arms Caliber Board report.

406 Straight case, hardened, 405 grain bullet, 70 grain dense musket powder; lubricant in cannelures, case 2.1 inches long lapping .61 inch on the bullet made at Springfield, and recommended by Small-Arms Caliber Board, No. 58 of its report. F. A. Am. No. 280.

407 Straight case; substantially like last, but made by machinery at Frankford Arsenal, after adoption by War Department. F. A. Am. No. 294.

[".42 caliber]

408 Bottle-shaped case, 80-grain charge, 350-grain bullet, cannelured; length of cartridge 2.6 inches. F. A. Am. No. 139. Reported on April 22, 1871, and January 6, 1872.

409 Bottle-shaped case, 75-grain charge, 350-grain bullet, cannelured; length of cartridge 2.5 inches. F. A. Am. No. 140. Reported on January 6, 1872.

410 Bottle-shaped case, 70-grain charge, 350-grain bullet, cannelured; length of cartridge 2.4 inches. F. A. Am. No. 141. Reported on April 22, 1871, and January 6, 1872.

411 Bottle-shaped case, 80-grain charge, 370-grain bullet, cannelured; length of cartridge 2.6 inches. F. A. Am. No. 142. Reported on April 22, 1871, and January 6, 1872.

412 Bottle-shaped case, 75-grain charge, 370-grain bullet, cannelured; length of cartridge 2.5 inches. F. A. Am. No. 143. Reported on April 22, 1871, and January 6, 1872.

413 Bottle-shaped case, 70-grain charge, 370-grain bullet, cannelured; length of cartridge 2.4 inches. F. A. Am. No. 144. Reported on April 22, 1871, and January 6, 1872.

414 Bottle-shaped case, 80-grain charge, 385-grain bullet, cannelured; length of cartridge 2.6 inches. F. A. Am. No. 145. Reported on April 22, 1871, and January 6, 1872.

415 Bottled-shaped case, 75-grain charge, 385-grain bullet, cannelured; length of cartridge, 2.5 inches F. A. Am. No. 146. Reported on April 22, 1871, and January 6, 1872.

416 Bottle-shaped case, 70-grain charge, 385-grain bullet, cannelured; length of cartridge, 2.4 inches. F. A. Am. No. 147. Reported on April 22, 1871, and January 6, 1872.

417 Bottle-shaped case, 80-grain charge, 350-grain bullet, smooth patched; inserted .4 inch. Lubrication base disk and dipped. F. A. Am. No. 206. Tested March and April, 1872.

418 Bottle-shaped case, 75-grain charge, 350-grain bullet, smooth patched; inserted .5 inch. Lubrication base disk and dipped. F. A. Am. No. 207. Tested March and April, 1872.

419 Bottle-shaped case, 80-grain charge, 370-grain bullet, smooth patched; inserted .4 inch. Lubrication base disk and dipped. F. A. Am. No. 209. Tested March and April, 1872.

420 Bottle-shaped case, 75-grain charge, 370-grain bullet, smooth patched; inserted .5 inch. Lubrication base disk and dipped. F. A. Am. No. 210. Tested March and April, 1872.

421 Bottle-shaped case, 75-grain charge, ratchet bullet, 373 grains. Lubricated in ratchet cannelures. F. A. Am No 169. Tested June, 1871.

422 to 427 Vacant.

428 Straight case, 70, 75, and 80-grain charges, 370-grain bullet, with four shallow cannelures; one exposed; same exterior (3.1 inches long) for all charges. F. A. Am. Nos. 239, 240, and 241. Made at Springfield Armory for Small-Arms Caliber Board, and represents Nos. 20, 21, and 22 of its report.

429 Straight case, 60, 65, 70, 75, and 80-grain charges, 365-grain bullet, with four deep (.02 inch) cannelures; one exposed; same exterior (3.1 inches long) for all charges. F. A. Am. Nos. 242, 252, 253, 254, 255, and 257. Made at Springfield Armory for Small-Arms Caliber Board, and represents Nos. 23, 33, 34, 35, 36, and 38 of its report.

430 Straight case, 65-grain charge, 365-grain bullet, with four deep cannelures, all covered by case. Length, 3 inches. F. A. Am. No. 267. Made at Springfield Armory for Small-Arms Caliber Board, and is No. 48 of its report.

431 Straight case, 65, 70, 75-grain charges, 365-grain bullet, four deep cannelures, all covered; case shortened. Total length, 2.8 inches; same for all charges. F. A. Am. Nos. 268, 278, and 279. Made at Springfield Armory for Small-Arms Caliber Board, and represents Nos. 49, 54, and 55 of its report.

[".40 caliber]

432 Bottle-shaped case, 75-grain charge, 350-grain bullet; smooth patched; base disk of lubricant and thick felt wad; parts made at Springfield Armory. F. A. Am. No. 171. Reported on October 28, 1871, on Form, Class 6.

433 Bottle-shaped case, 80-grain charge, 350-grain bullet; smooth patched; base disk of lubricant and thin felt wad, to increase powder space. Parts made at Springfield Armory. F. A. Am. No. 172. Reported on October 28, 1871, on Form, Class 6.

434 Bottle-shaped case, 75-grain charge, like No. 432, except that the case is re-enforced by a ring inside the flange. Parts made at Springfield Armory. F. A. Am. No. 193. Reported on January 4, 1872.

435 Bottle-shaped case, 80-grain charge, otherwise like last. F. A. Am. No. 194. Reported on January 4, 1872.

436 Vacant.

437 Vacant.

438 Vacant.

439 Straight case, charges 80, 75, 70, and 65 grains, 350-grain bullet, smooth greased patch; total length (same for all charges), 3.28 inches. F. A. Am. Nos. 221 to 228, inclusive. Made at Springfield Armory for Small-Arms Caliber Board, and represents Nos. 2 to 9, inclusive, of its report.

440 Straight case, 80-grain charge, 400-grain bullet, with seven cannelures; lubrication in cannelures. F. A. Am. No. 229. Made at Springfield Armory for Small-Arms Caliber Board, and is No. 10 of its report.

441 Straight case, 75, 70, and 65-grain charges, 350-grain bullet, with four cannelures; lubrication in cannelures; length the same for all charges. F. A. Am. Nos. 230, 231, and 232. Made at Springfield Armory for Small-Arms Caliber Board, and represents Nos. 11, 12, and 13 of its report.

442 Straight case, 70, 65, and 60-grain charges, 350-grain bullet, with five shallow (0.1 inch) cannelures; lubrication in cannelures; length the same for all charges. F. A. Am. Nos. 235, 236, and 237, and when dipped Nos. 233 and 234. Made at Springfield Armory for Small-Arms Caliber Board, and represents Nos. 14 to 18, inclusive, of its report.

443 Straight case, 65-grain charge, 340-grain bullet, with five deep (.02 inch) cannelures, three of which are covered by the case; lubrication in cannelures. F. A. Am. Nos. 238 and 263. Made at Springfield Armory for Small-Arms Caliber Board, and represents Nos. 19 and 44 of its report.

444 Straight case, like last, but bullet inserted until four cannelures are covered by case. For Small-Arms Caliber Board, and is No. 45 of its report.

445 Straight case, like last, but bullet inserted until all five of the cannelures are covered by the case, making the total length of cartridge 3 inches. F. A. Am. No. 265. Made at Springfield Armory for Small-Arms Caliber Board, and is No. 46 of its report.

446 Straight case, 70-grain charge, very light bullet (290 grains), smooth greased patch. F. A. Am. No. 243. Made at Springfield Armory for Small-Arms Caliber Board, and is No. 24 of its report.

447 Straight case, 65 and 70-grain charges, hardened bullet, 340 grains, one-twelfth tin, five deep cannelures, covered by case; length same for both charges; lubrication in cannelures. F. A. Am. Nos. 283, and 284. Made at Springfield Armory for Small-Arms Caliber Board, and represents Nos. 59 and 60 of its report.

448 Vacant.

449 Vacant.

TENTH DRAWER

SERVICE AMMUNITION AND STAGES OF MANUFACTURE

No. Description

450 ".50 caliber musket, 70 grain charge, 450-grain bullet; case, 143 grains; shallow copper cup anvil as made for service from January, 1872, to December 29, 1873. Letter of Chief of Ordnance, stopping manufacture. F. A. Am. No. 184.

451 ".50 caliber cadet musket, 45-grain charge, 385-grain bullet; case shortened to 1.33 inches; made originally for the short-chambered Remington navy carbine, model 1868. F. A. Am. No. 100. Reported on November 15, 1870, &c.

452 ".50 caliber carbine, 55-grain charge, 430-grain bullet, wtih ellipsoidal front; adopted January, 1872. F. A. Am. 191. Reported on December 28, 1871.

453 ".50 caliber pistol (Remington B. L.), 25-grain charge, 300-grain bullet; made for Army Remington B. L. pistol after July, 1871, and a nearly similar one for navy. F. A. Am. No. 168. Reported on June 12, 1871.
454 ".50 caliber blank musket, charge 70 or 80 grains; case 1.5 inches long; closed with tar composition and later with shellac. F. A. Am. Nos. 22 and 334.
455 ".50 caliber blank Gatling, charge 100 grains, case 2.25 inches long. Compressed and closed with varnish. F. A. Am. No. 335.
456 ".45 caliber rifle, charge 70 grains; bullet, 405 grains hardened. The cartridge adopted by Small-Arms Caliber Board as made of Frankford Arsenal, 1874. F. A. Am. No. 347.
457 ".45-caliber carbine, charge 55 grains; bullet, 405 grains, hardened. Made at Frankford Arsenal from September, 1873. F. A. Am. No. 348. Reported on August 20, 1873.
458 ".45 caliber pistol (Colt), charge 30 grains; bullet, 250 grains; made at Frankford Arsenal from September, 1873. F. A. Am. No. 320. Reported on September 15, 1873.
459 ".45 caliber blank rifle and carbine.
460 ".45 caliber revolver blank.
461 ".44 caliber pistol (Smith & Wesson), charge 30 grains; bullet, 225 grains; made at Frankford Arsenal from August, 1871. F. A. Am. No. 165. Reported on July 13 and 14, 1871.
462 ".44 caliber blank pistol (Smith & Wesson), charge 40 grains.
463 Musket powder for all small-arm cartridges. Light "Oriental" for ".50 caliber; dense "Hazard," &c. for ".45 caliber.
464 Lead bar for bullets of all cartridges except the ".45 caliber rifle and carbine.
465 Alloy bar for bullets: Tin, 1; lead, 16. For bullets of ".45 caliber.
466 Japan wax. Generally used for lubrication of bullets.
467 Bayberry wax, 8 parts; graphite; 1 part. Preferred for lubrication of bullets when bayberry wax obtainable.

Most of the collection is still retained at Frankford, preserved and remounted through the efforts of Col. George A. Miller, Jr. Unfortunately many of the specimens originally in drawers 1 to 3 (the older types) were destroyed or damaged during the years following the original display. Those remaining of this group have been rearranged to fill two frames and have been renumbered. The rest have the original numbers still assigned to them.

I have attempted to correlate the present numbers with those of the original catalog, as closely as is practicable without a detailed examination of the specimens. Where doubt exists, the specimen is either incomplete or badly damaged.

PAPER AND TRANSITION CARTRIDGES, FRANKFORD COLLECTION

Present Number	Old Number	Present Number	Old Number
28	15	61	60
29	5	62	51
30	32	63	65
31	29	64	64
32	22	65	48
33	4	66	40
34	35	67	69
35	1	68	74
36	53	69	66
37	42	70	67
38	25	71	38
39	9	72	36
40	10	73	47
41	13	74	61
42	11	75	?
43	14	76	59
44	21	77	77

45	23	78	78
46	24	79	?
47	17	80	81
48	20	81	79
49	3	82	80
50	19	83	75
51	16 (Type I)	84	91
52	12	85	88
53	52	86	87
55	2	87	86
56	90	88	84
57	30	89	85
58	55	90	82
59	57	91	83
60	58		

To assist the student of early ammunition in using the foregoing compilation a few observations will be made to correct errors or clarify ambiguities in the Metcalfe catalog.

The bullet diameters listed for the first three drawers are in most instances the nominal bore diameters of the arms involved; these were usually of different sizes than the bullets.

The grains of powder charges and of bullets are the specification weights. Few specimens will be found in which the components have these exact weights. Even in one box or lot fairly wide variations occur, as much as five grains difference being common.

Item 4 should read "rifle, 1841."

Item 5 lists a 60-grain pistol cartridge for the Model 1842 pistol. Such a load was in use only prior to 1834 and was probably intended for the Models 1819 and 1827 pistols.

Item 6 describes a 65-grain load for a "caliber .50 Savage belt pistol." The load mentioned corresponds to that used in the Harpers Ferry and Model 1808 Contract pistols, but in that case the ball should have been caliber 0.525. In any event, the "Savage" must have been in error. The only Savage arm that took a special load was the caliber 0.36 Navy revolver.

The "Melford" subcaliber cartridge of item 8 should read "Mefford."

The charges for types I and II Williams cartridges, items 16 and 17, are reversed. They should read 60 and 65 grains respectively. The type I was used through most of the war, but the type II came in 1864, the same year that the standard powder charge was changed from 60 to 65 grains.

The "Merrit" arms listed in items 26 to 31 inclusive should read "Merrill." I saw the original specimen, which was a Merrill carbine

cartridge, labeled in ink. The letter "l" was written with tails at top and bottom which could easily have been taken for a "t."

Items 41 and 45 mention "inserted paper" cartridges. These were made under the Gardner patent at Richmond and other Confederate arsenals. In this process the paper was inserted into a slit in the base of the bullet. The slit was then crimped down to hold the paper fast.

"Chadwick's cartridge, item 43, has not been identified by me, nor has any other reference to it been found. Some sizes of combustible cartridges made by Robert Chadwick are known.

Item 44 should read "Gardiner." This was an explosive bullet.

Item 46 refers to the Shaler 3-piece "sectional bullet."

Of the cartridges listed under the subheading "Gun-cotton, paper" (after item 46), only items 89, 90, and 91 are really composed of guncotton or other nitrocellulose. The rest should be classed as "combustible envelope" cartridges as the propellant is gunpowder.

Items 47 to 51 should read "Johnston & Dow's."

The revolver cartridge described under item 137 is for the French Perrin revolver; that listed as item 138 is for the French Rafael revolver. Both were used in the Civil War.

For convenience in identifying specimens of United States ammunition of the period when the muzzle-loader predominated, I have compiled a check list that shows the essential characteristics of the various types, many of which have been illustrated. This list has been made as complete as possible, using information believed to be reliable. Data are either from official sources or from identified specimens. In some cases only fragmentary information was available. At some later date many gaps can no doubt be filled as those interested find additional specimens for analysis. I should appreciate receipt of more light on this subject.

TABLE 11.—CARTRIDGE CHECK LIST

PAPER AMMUNITION

No.	Caliber	Type and Model	Date Used	Bullet: Diameter inches	Bullet: Weight grains	Powder Charge grains	Total Weight grains	Total Length inches	Remarks	Source of Data	Plate
		MUSKETS—SMOOTH BORE									
1	0.75	Ball Brown Bess	1776	0.688	14/lb.	164	694.5	?	Charge includes 10-12 gr. priming.	Duana	...
2	....	Buckshot Brown Bess	1780	(9 buck)	....	164	428	2.8	do.	Specimen	23g
3	0.70	Ball Charleville	1776	0.630	19/lb.	189	601.5	3.5	Consider Rev. Bullet and Ticonderoga Museum.	Specimen	23a
4	0.70	Blank Charleville	1776	....	....	...	242	3.0	Blue Paper.	Specimen	23d
5	0.69 and 0.70	Ball M1795, M1808	1810	0.630	19/lb.	?	?	?		Deane	...
6	0.69	Ball M1808	1816	0.640	18/lb.	160	556	2.75	From "Tests of Gunpowder," Mordecai, 1845.		23b
7	....	Buck-and-ball M1808	1816	0.640 3 buck	18/lb. and 180/lb.	160	?	?	Wt. ball 397.5 gr.	Inventories	...
8	....	Buckshot M1808	1816	15 buck	180/lb.	160	?	3.25		Inventories	...
9	....	Blank M1808	1816	....	....	?	?	2.4		Inventories	...
10	0.69	Ball M1808, M1822	1834	0.640	18/lb.	144	553	?	Charge includes 10 gr. priming.	Ord. Reg. 1834	...
11	....	Buck-and-ball M1822	1834	0.640 3 buck	18/lb. 180/lb.	144	?	?		do.	...
12	....	Buckshot M1822	1834	15 buck	180/lb.	144	?	?		do.	...
13	....	Blank M1822	1834	....	....	120	?	?		do.	...
14	0.69	Ball M1822, 1840	1837	0.640	18/lb	144	553	?	Charge includes 10 gr. priming.	Rep. 1837 Tests	...
15	....	Buck-and-ball 1840	1837	0.640 3 buck	18/lb. and 180/lb.	144	?	?		do.	...
16	0.69	Ball 1840	1839	0.640	18/lb.	130	538.3[1]	2.5	Charge includes 10 gr. priming.	MSS Ord. Man. 1839	24a
17	....	Blank 1840	1839	....	....	117	?	1.75		do.	24d
18	....	Buck-and-ball M1822, 1840	1840	0.640 3 buck	18/lb. and 170/lb.	130	?	2.75	Cal. .30 buckshot.	Ord. Man. 1841	24b
19	....	Buckshot M1822, 1840	1840	12 buck	170/lb.	130	?	2.8	do.	do.	24c
20	0.69	Ball M1842 perc.	1844	0.640	18/lb.	120	528	2.4	Change entered 1845 in copy Ord. Man. 1840.	do.	...
21	....	Ball M1842 perc.	1845	0.650	17/lb.	110	?	2.2	Wt. ball 412 gr.	Ord. Man. 1849	25a
22	0.69	Buck-and-ball 1842	1845	0.65 3 buck	17/lb. and 150-155/lb.	110	?	2.4	Cal. .31 buckshot.	do.	25b

[1] The paper envelope for cal. .69 flintlock ball cartridge weighed 10.8 grains.

CARTRIDGE CHECK LIST—*Continued*

23	....	Buckshot 1842	1845	12 buck	150-155/lb.	110	?	2.8	Cal. .31 buckshot.	do.	25c
24	....	Blank 1842	1861	....	....	75	?	1.1	1861 Ord. Man.	do.	25i
25	....	Mefford ball 1842	1863	0.50/0.65	259	110	?	2.9	Sub-caliber load.	Ord. Memo No. 1	25f
26	....	Mefford Buck-and-Ball 1842	1863	0.50/0.65	259 and 3 buckshot	...	?	2.9	do.	Specimen	26g
		RIFLED MUSKETS (Percussion)									
27	0.69	Ball (elongated) for M1842 altered	1842	0.685	640	80	?	2.4	Wt. includes plug.	F. A. Coll.	...
28	....	Ball (elongated) for M1842 altered	1850	0.685	730	80	?	2.4		do.	...
29	....	Ball (elongated) for M1842 altered	1855	0.685	730	70	?	2.25		S. A. 1856	26a
30	....	Buckshot (elongated) for M1842 altered	1861	15 buck	150-155/lb.	110	?	3.3	Cal. .31 buckshot.	Ord. Man. 1861	26b
31	....	Blank (elongated) for M1842 altered	1861	....	....	70	?	1.0		Pitman	..
		MUSKETOON—SMOOTH BORE									
32	0.69	Ball M1835, 1840	1839	0.640	18/lb.	85	?	1.8	Charge includes 10 gr. priming.	MSS Ord. Man. 1839	24e
33	....	Blank M1835, 1840	1839	....	...	77	?	1.25	do.	do.	24h
34	....	Buck-and-ball M1835, 1840	1840	0.64 / 3 buck	18/lb. and 170/lb.	85	?	2.25	do.	Ord. Man. 1841	24f
35	....	Buckshot M1835, 1840	1840	12 buckshot		85	?	2.5	Cal. .30 buckshot.	do.	24g
36	0.69	Ball M1847 (perc.)	1849	0.650	17/lb.	75	528	1.71	433-grain ball.	Ord. Man. 1849	25f
37	....	Buck-and-ball M1847 (perc.)	1849	0.65 / 3 buck	17/lb. and 170/lb.	75	662	2.1	433-grain ball.	do.	25g
38	....	Buckshot M1847 (perc.)	1849	12 buck	170/lb.	75	625	2.4	Cal. .30 buckshot.	Pitman	25h
39	....	Blank M1847 (perc.)	1849	....	....	75	...	1.1	Same as musket.	do.	25l
		RIFLED MUSKETOON (Percussion)									
40	0.69	Ball (elongated) M1842	1845	0.685	630	47	682	2.05	Wt. ball includes wooden plug.	Mordecai	...
41	....	Ball (elongated) M1842	1856	0.685	695	50	748	2.0	Solid.	Specimen	26c
42	....	Ball (elongated) M1842	1861	0.685	725	47	778	2.12		Pitman	...
43	....	Buckshot M1842	1861	12 buck	170/lb.	47	...	2.05		do.	...
44	....	Blank M1842	1861	....	....	...	...	...	Same as perc. musket.	Ord. Man. 1861	25l
		COMMON RIFLE, CALIBER .54									
45	0.54	Ball Harper's Ferry M1804	1810	0.525	32/lb.	?	?	?	Wt. ball 219 grains.	Duane	...
46	....	Ball M1804, 1814, 1819	1834	0.525	32/lb.	100	332.4	2.6	Patched ball.[3]	Ord. Reg. 1834	27d

[3] The rifle patch weighed 3.4 grains.

47	....	Blank M1804	1834	....	....	73	?	?		do.	...
48	....	Blank M1804	1839	....	....	90	102	1.75		MSS Ord. Man. 1839	27e
49	0.54	Ball M1841 (perc.)	1842	0.525	32/lb.	100	332.4	2.6	Patched ball.	Mordecai	...
50	....	Blank M1841 (perc.)	1842	....	....	90	102	1.75		do.	...
51	....	Blank M1841 (perc.)	1849	....	....	75	...	...		S. A. 1856	...
52	....	Ball M1841 (perc.)	1849	0.525	32/lb.	75	?	2.2	Patched ball.	Ord. Man. 1849	27h
53	....	Blank M1841 (perc.)	1849	....	....	60	?	1.3		do.	27i
54	0.54	Ball (elongated) perc.	1854	0.545	400	50	?	?	Hollow base ball.	S. A. 1856	...
55	....	Ball (elongated) perc.	1860	0.540	570	60	?	2.3		F. A. Coll.	28a
56	....	Ball (elongated) perc.	1863	0.540	455	60	?	2.4		Ord. Man. 1863	28b
57	....	Shell, Explosive	1863	0.54	363	60	?	2.3	Gardiner's Pat.	Med. & Surg. Hist.	...
		HALL'S RIFLE, CALIBER .525									
58	0.525	Ball M1819	1834	0.525	32/lb.	100	?	?	Bare ball.	Ord. Reg. 1834	...
59	....	Blank M1819	1834	....	....	73[3]	...	...		do.	...
60	0.525	Ball M1819	1837	0.525	32/lb.	78	305.2	?	Charge includes 10 gr. priming.	Rep. Tests 1837	...
61	....	Ball M1819	1839	0.525	32/lb.	100	?	2.5		MSS Ord. Reg. 1839	27g
62	....	Blank M1819	1839	....	....	90[4]	...	...		do.	...
63	....	Ball M1819	1842	0.525	32/lb.	70[5]	...	...		Mordecai	...
64	0.52	Ball (Alt. to perc.?)	1863	0.52	395	41	447	1.88		Med. Mus. Coll.	...
		RIFLE-MUSKET AND RIFLE, CALIBER .58									
65	0.58	Ball (elong.) M1855 and M1841 (alt.)	1856	0.5775	500	60	565	2.5		S. A. 1856	...
66	....	Ball (elong.) M1855 and M1841 (alt.)	1863	0.577	500	60	580	2.5		Ord. Man. 1861	28c
67	....	Blank (elong.) M1855 and M1841 (alt.)	1861	....	....	60	?	1.4		do.	...
68	....	Ball (elong.) M1855 and M1841 (alt.)	1864	0.577	500	65	585	2.5		S. O. 1864	...
69	....	Ball (elong.) M1855 and M1841 (alt.)	1864	0.571	470	65	555	2.5	St. Louis Ars.	Ord. Memo No. 1	..
70	0.58	Ball, Shaler's, Sectional	1863	0.574	720	55	806.5	2.27	3-piece bullet.	Pitman	...
71	....	Ball, Shaler's, Sectional	1863	0.58	608	55	695	2.5	do.	Med. Mus. Coll.	...
72	....	Ball, Shaler's, Sectional	1863	0.574	668	55	761	2.75	do.	Specimen	28h
73	....	Ball, Williams, Type I	1863	0.574	555	60	635	2.4[6]	Bore cleaner.	F. A. Coll.	28g
74	....	Ball, Williams, Type II	1864	0.574	465	60	541	2.375[6]	do.	do.	...
75	....	Ball, Williams, Type II	1864	0.574	465	65	546	2.5		Specimen	28d
76	....	Ball, Williams, Type II	1864	0.574	566	65	?	?		Specimen	28f
77	....	Shell, Gardiner's Explosive	1864	0.574	450	60	530	2.1	Powder-train fuze.	F. A. Coll.	29d

[3] Same cartridge as rifle blank of 1834.
[4] Same as rifle blank.
[5] Same cartridge (70 gr.) as Cadet musket, though chamber will hold 75 grains.
[6] Williams cartridges were usually wrapped in blue paper for identification.

CARTRIDGE CHECK LIST—*Continued*

		HALL'S CARBINE OF MUSKET CALIBER								
78	0.64	Ball (Flintlock)	1837	0.640	18/lb.	110[7]	517.7	?	Bare ball.	Rep. Tests 1837	...
79	....	Ball (Perc.)	1837	0.640	18/lb.	86	?	?	Bare ball.	do.	...
80	....	Ball (Perc.)	1839	0.640	18/lb.	75	?	1.75	397.5-grain ball.	MSS Ord. Reg. 1839	...
81	....	Blank (Perc.)	1839	....	....	68	?	1.15		do.	25d
82	....	Buck-and-ball (Perc.)	1840	{ 0.64 3 buck	18/lb. 170/lb.	75	?	2.1	Cal. .30 buck.	Ord. Man. 1841	25e
83	0.67(?)	Ball (Perc.)	1863	0.675	?	?	?	?	Reamed up from older models.	Ord. Memo No. 1	...
		HALL'S CARBINE OF RIFLE CALIBER								
84	0.52	Ball (Perc.)	1834	0.525	32/lb.	85	?	?	Bare ball.	Ord. Reg. 1834	...
85	....	Blank (Perc.)	1834	....	....	62	?	?		do.	...
86	....	Ball (Perc.)	1839	0.525	32/lb.	75	?	?		MSS Ord. Man. 1839	...
87	....	Blank (Perc.)	1839	....	....	68	?	1.6		do.	...
88	....	Ball, M1840, North	1842	0.525	32/lb.	100	329[8]	...		Mordecai	...
89	....	Ball (Perc.)	1849	0.525	32/lb.	75	?	2.1		Ord. Man. 1849	27j
90	....	Blank (Perc.)	1849	....	....	60[9]	?	1.3		do.	...
		PISTOLS								
91	0.58	Ball, British "Tower"	1776	0.51	34/lb.	82	?	?		Duane	...
92	0.56	Ball, Harper's Ferry	1810	0.525	32/lb.	65(?)	?	?		do.	...
93	0.56	Blank	1810-1820	....	....	65	74	1.25	Top pasted.	Specimen	31e
94	0.67	Contract, 1808-1816	1847[10]	0.638	18/lb.	65	471	1.87	May be for converted pistol.	Specimen	31a
	....	Blank, 1808-1816	1812-1830	....	....	75	93	1.5	Navy?	do.	31b
95	0.54	Ball, Contract, 1816-27	1830	0.525	32/lb.	60	?	2.0		do.	31c
96	....	Ball, Contract, 1816-27	1834	0.525	32/lb.	51	269	1.55		Ord. Reg. 1834	...
97	....	Blank	1830	....	....	55	66	1.5		do.	31d
98	0.54	Blank, Contract, M1819, 1827	1834	....	....	51	?	?		Ord. Reg. 1834	...
99	0.54	Ball, M1836	1839	0.525	32/lb.	50	?	1.65		MSS Ord. Man. 1839	31f
100	....	Blank, M1836	1839	....	....	50	?	1.38		do.	31h
101	....	Blank, M1836	1840	....	....	45	?	1.2		Ord. Man. 1841	31g
102	0.54	Ball, M1842 (Perc.)	1842	0.525	32/lb.	35	259.5	1.55		Mordecai	31i

[7] Perhaps this was the percussion carbine with a receiver from one of the flintlock Hall rifles, which held 110 grains, though its usual charge was 100.
[8] The cartridge paper weighed 10 gr.
[9] Same as rifle blank.
[10] For pistol converted to perc. system. Presumably the flintlock charge would be about 73 grains.

103	....	Ball, M1842 (Perc.)	1849	0.525	32/lb.	30	?	1.18	1845 Ord. Bd.	Ord. Man. 1849	31j
104	....	Blank, M1842 (Perc.)	1849	....	....	30	?	0.80		do.	31k
105	0.58	Ball, M1855 pistol-carbine	1855	0.5775	450 gr.	40	517	1.9		S. A. 1856	...
106	....	Ball, M1855 pistol-carbine	1861	0.577	450 gr.	40	?	1.9		Ord. Man. 1861	31l
107	....	Ball, M1855 pistol-carbine, Williams	1863	0.577	456	40	524	2.2		Specimen	31n

MISCELLANEOUS ARMS

CADET MUSKETS AND RIFLES

108	0.575	Ball, M1830, flint	1835	0.525	32/lb.	70	?	?		Mordecai	...
109	....	Ball, M1830, flint	1839	0.525	32/lb.	75[11]	?	?		MSS Ord. Man. 1839	27j
110	....	Ball, M1841	1842	0.525	32/lb.	78	305.2	?		Mordecai	...
111	0.58	Ball (elong.) M1851	1855	0.5775	450	40[12]	?	?		S. A. 1856	...
112	0.54	Ball (elong.) M1855	1855	0.540	417	50[13]	?	?	Hollow-base ball.	do.	...
113	0.58	Ball, M1851	1861	0.577	450	50	?	?		Ord. Man. 1861	...

CARBINES AND RIFLES

114	0.54	Ball, Chadwick's, for M1841 Rifle	?	0.54	420	50	?	?		F. A. Coll.	...
115	0.44	Ball, Colt's Rifle, sporting	1863	0.44	?	?	?	?		Ord. Memo No. 1	...
116	0.56	Ball Colt's Rifle	1863	0.58	490	45	?	?		do.	...
117	0.54	Ball Gibbs Carbine	1863	0.54	?	?	487	1.63		do.	36m
118	0.44	Ball Greene Carbine	?	0.45	?	?	266	2.25	Williams bullet.	Specimen	30e
119	0.54	Ball Greene Carbine	?	0.546	480	54	?	2.0		Specimen	30b
120	0.54	Ball Greene Rifle	1861	0.546	546	68	?	2.5	Oval bore, ball reversed in cart.	Pitman	30a
121	0.52	Ball Jenks Carbine	1842	0.525	32/ib.	70	297	?		Mordecai	...
122	0.50	Ball Joslyn Carbine	1859	?	?	?	?	?		House Doc. 99 40th Cong. 2d Ses.	...
123	0.54	Ball Joslyn Carbine	1859	0.55	?	?	?	?			
124	0.58	Ball Lindner Carbine	1859	0.574	?	?	?	?		F. A. Coll.	...
125	0.56	Ball Merrill Carbine	1859	0.56	410	40-50	472	1.64		do.	...
126	0.56	Ball Merrill Carbine	1863	0.55	400	40	449	1.62	1.12 in. case.	Specimen	36l
127	0.56	Ball Merrill Rifle	1859	0.56	450	50-60	?	2.38		Pitman	...
128	0.58	Ball Merrill for M1855 musket	?	0.58	455	50	?	?		F. A. Coll.	...
129	0.69	Ball Merrill for M1842 cal. .69 musket	1859	0.69	720	60-70	?	2.6	For Rifled musket.	do.	26i

[11] Used Hall carbine cartridge.
[12] This was the pistol-carbine cartridge.
[13] It is not clear in what model this cartridge was used. Perhaps it was an experimental arm.

CARTRIDGE CHECK LIST—*Continued*

130	0.69	Ball Merrill for musketoon............	?	0.69	715	50	?	2.3		do.	...
131	0.52	Ball Sharps Carbine.................	?	0.52	450	55	?	?		do.	...
132	0.56	Ball Sharps Carbine.................	1858	0.56	465	55	546	2.19	1.5 in. case.	Specimen	30m
133	0.56	Ball Sharps Carbine.................	1861	0.56	475	50	?	2.25		Ord. Man. 1861	30l
134	0.56	Ball Sharps Carbine.................	?	0.56	465	50	533	2.38	1.38 in. case.	Specimen	30k
135	0.54	Ball Sharps Rifle...................	1861	0.55	465	60	?	?		F. A. Coll.	...
136	0.54	Ball Sharps Rifle...................	?	0.55	475	60	557	2.81	1.83 in. case.	Specimen	30j
137	0.48	Ball Smith Rifle....................	?	0.485	400	93	509	2.23	1.62 in. case (11 gr.).	Specimen	40k
138	0.50	Ball Union Carbine..................	1863	0.53	390	40	432	1.75	1.06 in. case.	Specimen	36n
		REVOLVERS									
139	0.44	Colt's Army Rev. M1847 (Walker).....	1847	0.46	218	50	?	?	Alt. round-ball load, 50/lb.	Specimen	36o
140	0.44	Colt's Army Rev. New Model.........	1850	0.46	218	40	?	?	Alt. round-ball load, 48/lb.	Pitman	...
141	0.44	Colt's Army Rev. New Model.........	1856	0.46	232	30	267 [14]	2.0		Specimen	36p
142	0.44	Colt's Army Rev....................	1858	0.46	212	25	253 [14]	1.87	Alt. round-ball load, 48/lb.	Pitman	36q
143	....	Colt's Army Rev. Blank..............	1858	....	....	30	36 [14]	1.25		Specimen	36r
144	0.44	Colt's Army Rev. M1860.............	1860	0.46	260	17	?	1.75	Shellac.	F. A. Coll.	36s
145	0.44	Colt's Army Rev. M1860.............	1861	0.46	216	30	?	?		Ord. Man. 1861	...
146	0.44	Colt's Army Rev. M1860.............	?	0.46	212	17	234	1.25		Specimen	36j
147	0.44	Colt's Pistol-carbine	1860	0.46	260	20	?	?		F. A. Coll.	..
148	0.36	Colt's Navy Rev. M1851.............	1851	0.38	140	20	170	?	Shellac.	do.	36t
149	0.36	Colt's Navy Rev. M1851.............	1861	0.39	145	17	?	$1\frac{9}{16}$		Ord. Man. 1861	...
150	0.36	Colt's Navy Rev. M1851.............	?	0.38	150	15	170	1.38		Specimen	36l
151	0.36	Colt's Navy Rev. M1851.............	?	0.38	135	12	?	?		F. A. Coll.	...
152	0.36	Colt's Navy Rev. M1851 Blank........	?	....	....	20	24	1.19		Specimen	36h
153	0.36	Savage Navy Rev....................	1861	0.38	150	10	?	?		F. A. Coll.	...
154	0.36	Savage Army Rev....................	1858	0.38	182	16	?	?	North & Savage.	do.	...
155	0.36	Savage Army Rev....................	?	0.38	147	16½	?	?		do.	...
		CONFEDERATE PAPER AMMUNITION									
156	0.69	Ball Smooth-bore musket.............	1863	0.638	?	?	524	2.25	Augusta Arsenal (pinkish, caps in blue).	Specimen	33c
157	0.69	Ball Smooth-bore musket.............	1863	0.636	?	?	516	2.1	Richmond Arsenal (grey).	do.	33b
158	0.69	Ball Smooth-bore musket.............	1863	0.637	?	?	526	2.1	Selma Arsenal (grey).	do.	33a
159	0.69	Buck-and-ball	?	0.64	?	?	645	2.4	New Orleans Depot (brown).	Steuart	33e
160	0.69	Buck-and-ball	?	0.64	?	?	650	2.5	Richmond Arsenal (brown).	do.	33d
161	0.69	Buckshot	?	?	?	?	596	2.7	New Orleans Depot (orange or brown).	do.	33f

[14] Made with yellow paper.

162	0.69	Rifled Musket	?	0.67	...	...	641	2.3	Inserted (pink).	Specimen	33k
163	0.64	Hall's carbine (?)..................	?	0.62	...	...	625	2.3	do.	do.	33l
164	0.577	Rifle	1863	....	...	...	578	2.4	Macon Arsenal (white).	do.	33j
165	0.577	Rifle-musket	1862	0.577	520	60	597	2.3	Inserted.	do.	33m
166	0.577	Rifle-explosive	1863	0.574	500	50	563	2.25		do.	29i
167	0.54	Rifle-explosive	1863	0.53	...	...	...	...	Bullet only.	do.	29m
168	0.54	Rifle	?	0.54	492	?	?	?	Inserted.	do.	33n
169	0.54	Ball Merrill Carbine.................	1862	0.56	?	?	?	1.6		Pitman	32b
170	0.54	Rifle	?	0.54	450	68	536	2.38	Salmon.	Specimen	33i
171	0.52	Ball Sharps Carbine.................	1862	0.53	450	50	514	2.5		do.	32f
172	0.45	Ball ?	?	0.42	?	?	293	1.92	Inserted.	Specimen	33o
173	0.44	Ball Colt's Rev.....................	1861	0.46	?	?	?	1.25	Exposed ball.	Specimen	32a
174	0.35	Ball Maynard Carb...................	1863	0.37	?	31.8	190	2.0	Savannah Depot.	Specimen	32d

FOREIGN AMMUNITION USED IN CIVIL WAR

175	0.75	Ball, British M1842................	1862	0.731	835(?)	2¾ dr.	899	2.63	Sea Serv. (yellow).	Specimen	34d
176	0.75	Ball, British Pistol.................	1862	0.74	?	2½ dr.	599	1.75	White.	do.	34e
177	0.71	Ball, French M42/65...............	1861	0.68	?	?	?	2.30	Conical ball.	do.	35a
178	0.70	Ball French musket.................	1861	0.68	?	?	?	2.55	Round ball, inside primed.	do.	35b, c
179	0.70	Buck French musket.................	1861	....	?	?	?	2.00	Inside primed.	do.	35d, e
180	0.71	Ball Austrian musket................	1861	0.71	685	75	?	2.8	Conical ball.	F. A. Coll.	35f
181	0.70	Ball Austrian musket................	1861	0.70	?	?	?	2.9	do.	do.	35h
182	0.70	Ball Belgian musket.................	1861	0.70	765	70	?	2.5	do.	do.	35j
183	0.702	Ball, British M1835/51.............	1862	0.675	?	2½ dr.	805	2.5	Minié bullet.	Specimen	34b, c
184	0.62	Ball, British carbine................	1862	0.62	?	2½ dr.	423	2.13	Grey.	do.	34a
185	0.62	Ball, British pistol.................	1862	0.62	?	2 dr.	440	1.5	White.	do.	34f
186	0.577	Ball Enfield Rifle...................	1862	0.568	530	60	?	2.5	U. S. made.	F. A. Coll.	35i
187	0.577	Ball Enfield M1853.................	1861	0.57	530	68	621	3.0	Eley (white).	Specimen	34k
188	0.577	Ball Enfield M1853.................	1864	0.55	530	70	624	2.95	Service (grey).	do.	34i
189	0.577	Ball Enfield Carbine.................	1863	0.55	?	?	?	2.68	do.	...	...
190	0.45	Ball Whitworth Rifle................	1862	0.442	530	85	?	3.9	Hexagonal ball.	do.	32g
191	0.45	Ball Whitworth Rifle................	1862	0.442	530	85	?	3.88	Cylindrical ball.	do.	32h
192	0.45	Ball Whitworth Rifle................	1862	0.442	530	70	?	3.6	do.	do.	32i
193	0.45	Ball Whitworth Rifle................	1862	0.442	530	60	?	3.4	do.	do.	32j
194	0.45	Ball British Whitworth..............	1862	0.442	480	75	574	4.5	Service (grey).	Royal Lab. 1865	34g
195	0.44	Ball British Kerr rifle...............	1862	0.44	460	?	?	?	From Resaca, Ga.	Specimen	32e

CARTRIDGE CHECK LIST—*Continued*

No.	Caliber	Model Arm	Bullet Diameter	Bullet Weight	Powder Charge	Total Weight	Length Case	Over-all Length	Remarks	Source of Data	Plate
		BALL CARTRIDGES OF CIVIL WAR PERIOD									
		LINEN CASE									
196	0.54	Starr Carbine	0.555	444	62	525	1.40	1.96		Ord. Memo No. 1	36a
197	0.52	Sharps Carbine	0.54	450	60	526	1.39	2.06		do.	36b
198	0.52	Gibbs Carbine	0.54	?	?	?	?	1.63		do.	...
199	0.50	Unknown Carbine	0.50	...	..	...	...	1.63	May be Jenks.	Specimen	36d
200	0.50	Union Carbine	0.52	390	40	432	1.00	1.63	Cosmopolitan.	Ord. Memo No. 1	36c
201	0.50	Unknown	0.48	...	..	...	...	2.31	May be Perry.	Specimen	36e
202	0.44	Colt's Army Rev.	0.46	232	25	261	?	?		do.	36f
203	0.36	Colt's Navy Rev.	0.386	135	17	154	?	?		do.	36g
		POULTNEY'S PATENT (Foil and Paper)									
204	0.54	Burnside Carbine	0.56	370	40	?	1.9	2.3		F. A. Coll.	39g
205	0.51	Gallager Carbine	0.525	374	50	450	1.69	2.12	Straight seam.	Specimen	39n
206	0.51	Gallager Carbine	0.525	?	?	463	1.69	2.12	Diagonal seam.	do.	39m
207	0.50	Smith Carbine	0.522	377	52	468.8	1.37	1.84	Straight seam.	Pitman	...
208	0.50	Smith Carbine	0.525	376	40	461	1.34	1.75	do. (45 gr. case).	Specimen	40n
209	0.50	Smith Rifle	0.52	376	62	503	1.44	2.0	Diagonal seam (65 do.).	do.	40m
210	0.50	Maynard Carbine	0.52	342	50	486.4	1.30	1.87	Diagonal seam.	Pitman	40a
211	0.50	Maynard Carbine	0.52	?	?	442	1.19	1.69	Straight seam.	Specimen	40b
		JACKSON'S PATENT (Tinned-iron and paper)									
212	0.51	Gallager Carbine	0.52	430	55	564	1.75	2.12		Specimen	39p
		SOLDERED FOIL									
213	0.51	Gallager Carbine	0.52	410	60	?	1.63	2.0		F. A. Coll.	39o
214	0.50	Smith Carbine	0.52	380	50	461	1.38	1.9		do.	40l
215	0.44	Colt's Army Rev.	0.46	?	?	?	?	1.12		Specimen	38q
216	0.36	Colt's Navy Rev.	0.38	?	?	?	?	?		do.	...

		NONMETALLIC CARTRIDGES									
217	0.56	Smith Carbine	0.565	425	50	552	1.44	2.09	Rubber Case.	Specimen	40g
218	0.52	Smith Carbine	0.525	368	50	504	1.54	2.06	Rubber Case.	do.	40h
219	0.50	Smith Carbine	0.50	350	40	468	1.47	2.00	Rubber Case.	do.	40i
220	0.48	Smith Carbine	0.48	407	50	542	1.52	2.13	Rubber Case.	do.	40j
		COMBUSTIBLE CARTRIDGES									
		COLT'S PT. FIRE ARMS MFG. CO.									
221	0.56	Revolving Rifle	0.58	490	45	541	...	2.0		Standish	37c
222	0.44	Pistol-carbine	0.46	260	20	?	...	1.5		F. A. Coll.	...
223	0.44	Army Revolver	0.46	260	17	?	...	1.38		Specimen	38e
224	0.36	Navy Revolver	0.38	135	12	?	...	1.25		do.	...
225	0.36	Savage Revolver	0.38	150	10	?	...	1.13		do.	...
		D. C. SAGE & CO. (Hotchkiss Pt.) "Water-proof skin" and "Seamless skin" cartridges									
226	0.54	Requa Battery	0.54	390	65	?	...	?		F. A. Coll.	...
227	0.44	Army Revolver	0.46	203	24	230	...	1.50	Water-proof.	Specimen	38c
228	0.44	Army Revolver	0.46	260	17	280	...	1.40	Seamless.	Specimen	38d
229	0.36	Navy Revolver	0.38	129	16	148	...	1.25	do.	Pitman	38z
230	0.36	Savage Revolver	0.38	178	14	199	...	1.42	Specimen shown is damaged.	Specimen	38bb
231	0.36	Whitney or Colt Navy Revolver	0.38	139	14	157	...	1.32		do.	38aa
232	0.36	Whitney Revolver	0.38	126	15	144	...	1.23		Pitman	...
		HAYES' PT. (skin wrapped, and in paper tube)									
233	0.54	Rifle	0.525	410	60	?	?	1.66	Minus casing.	F. A. Coll.	37e
234	0.44	Army Revolver	0.46	210	22	?	0.88	1.1		Specimen	38j
235	0.36	Navy Revolver	0.38	150	17	?	?	?		F. A. Coll.	...
		HAZARD POWDER CO. (Doremus & Budd Pt.) Skin Cartridge									
236	0.69	Rifled-Musket	0.685	745	70	811	...	1.95		Specimen	37k
237	0.58	Rifled-Musket	0.577	475	60	541	...	1.82		do.	37l
238	0.58	Rifled, Williams Ball	0.574	465	60	?	...	?		F. A. Coll.	...
239	0.56	Colt's Rifle	0.58	480	55	?	...	2.0		Specimen	37m

CARTRIDGE CHECK LIST—*Continued*

240	0.54	M1841 Rifle	0.534	450	70	520	...	1.81		Pitman	...
241	0.54	M1841 Rifle ?	0.54	...	..	511	...	1.82		Specimen	37n
242	0.52	Sharps Carbine	0.54	450	50	503	...	1.77		F. A. Coll.	37o
243	0.52	Sharps Rifle (?)	0.54	435	60	498	...	2.05	(Hall carbine?)	Specimen	37p
244	0.44	Army Revolver	0.46	240	25	267	...	1.3		do.	38g
245	0.36	Navy Revolver	0.38	150	17	?	...	1.19		Pitman	38v
		BARTHOLOW'S PT. (Shellac and silk)									
246	0.69	Smooth-bore Musket	0.69	500	65	?	...	?	Round ball.	F. A. Coll.	...
247	0.69	Rifle-Musket, M1842	0.685	750	70	825	...	1.88	Conical ball.	Specimen	37q
248	0.58	Rifle-Musket, M1855	0.577	490	65	565	...	1.75		F. A. Coll.	...
249	0.577	Enfield Rifle	0.574	512	53	570	...	1.88		Specimen	37s
250	0.54	Rifle, M1841	0.535	450	50	508	...	1.70		do.	37t
251	0.44	Army Revolver	0.46	260	20	281	...	1.34		do.	37u
252	0.36	Navy Revolver	0.38	140	14	156	...	1.09		F. A. Coll.	37v
253	0.31	Belt Revolver	0.34	?	?	94	...	1.0		Specimen	37w
		JOHNSTON & DOW'S PT.									
254	0.58	Rifle-Musket M1855	0.580	500	60	558	...	2.0		Specimen	37j
255	0.577	Enfield Rifle	0.574	500	60	563	...	1.81		do.	37l
256	0.52	Sharps Carbine	0.53	410	50	465	...	2.06		do.	37h
257	0.44	Army Revolver	0.46	212	25	238	...	1.75		do.	37g
258	0.36	Navy Revolver	0.38	150	17	170	...	...		F. A. Coll.	...
		MISC. COMBUSTIBLE CARTRIDGES									
259	0.58	Rifle Musket Von Lenk Guncotton	0.57	526	26	563	...	3.7	Austrian.	F. A. Coll.	37a
260	0.58	Barlow Patent	0.57	540	40	585	...	2.47	Nitrated blue paper.	do.	37b
261	0.44	Army Revolver (Eley)	0.46	?	?	?	...	1.6		Specimen	38k
262	0.44	Adams Revolver (Eley)	0.45	?	?	?	...	1.25		do.	38l
263	0.36	Navy Revolver (Eley)	0.38	?	?	?	...	1.3		do.	38t
264	0.56	CSA Colt Rifle	0.58	?	?	?	...	2.0		Steuart	33c
265	0.44	Colt Revolver	0.46	...	..	...	...	1.7	Colt, Comb. Envelope.	Specimen	38a
266	0.44	Colt Revolver	0.46	...	..	272	...	1.4	Watervliet Ars.	do.	38h
267	0.44	Colt Revolver	0.46	...	..	...	...	1.6	Colt, skin.	Specimen	38i
268	0.36	Navy Revolver	0.38	?	?	?	...	1.31	"Explosive tip" cartridge.	Pugsley	38w
269	0.36	Navy Revolver	0.38	130	12	145	...	1.14	Red paper.	Watervliet Ars.	38y

SEPARATE IGNITION, METALLIC

270	0.80	Machine Gun	0.80	?	?	?	3.5	4.6		Gatling?	Specimen	42a
271	0.58	Union Machine Gun	0.577	465	40	?	2.75	2.75		"Coffee Mill" gun	Specimen	42b
272	0.54	Billinghurst and Requa Battery	0.545	390	93	?	2.05	2.55			H. P. White Co.	42c
273	0.54	Burnside Carbine	0.565	400	53	534	1.89	2.38		Brass case	do.	39j
274	0.54	Burnside Carbine	0.565	400	45	528	1.83	2.35		Tinned case (FA)	Specimen	39i
275	0.50	Maynard Carbine	0.518	343	50	486	1.25	1.87		Pointed ball.	Pitman	40c
276	0.50	Maynard Carbine	0.518	343	40	475	1.21	1.75		Blunt ball (FA)	Ord. Memo No. 14	40d
277	0.50	Maynard Carbine	0.518	350	43	485	1.22	1.61		Blunt ball (FA)	Pitman	...
278	0.50	Maynard Carbine	0.518	?	?	426.7	0.56	1.18			do.	...
279	0.51	Gallager Carbine	0.52	435	60	?	1.67	2.0		Paper lined	F. A. Coll.	39r
280	0.51	Gallager Carbine	0.52	435	60	?	1.70	2.15		Unlined	do.	39q
281	0.50	Union(?) Carbine	0.52	?	?	?	1.69	2.0		May be variant Gallager.	Pitman	42m
282	0.50	Union(?) Carbine	0.52	?	?	?	1.50	1.97		do.	do.	42n

SELF-CONTAINED CARTRIDGES—SPECIAL TYPES

283	0.69	Morse R. Musket	0.685	(chamber about 0.72")			1.5	?		Cast case.	Ord. Records	...
284	0.58	Morse Rifle	0.58	?	52	624	1.5	2.26		Tinned case	F. A. Coll.	39a
285	0.54	Morse Rifle	0.54	?	?	?	1.5	2.06		Tinned case	Pitman	39b
286	0.50	Morse Carbine	0.50	?	?	523	1.52	2.14		CSA	Specimen	39c
287	0.50	Smith Carbine	0.52	?	?	477	1.31	1.75		Crispin Pt.	Specimen	40r
288	0.50	Smith Carbine	0.52	?	?	417	1.38	1.88		do.	do.	40q
289	0.44	Smith Carbine	0.45	?	?	465	1.31	1.97		do.	do.	40s
289a	0.50	Smith Rifle	0.50	?	?	?	1.44	2.03		do.	do.	40p

PIN-, RIM-, AND CENTER-FIRE CARTRIDGES (Self-contained)

PIN-FIRE

									Chamber Diameter			
290	12mm	Lefaucheux Rev.	12mm (0.445)	...	..	322	0.80	1.32	0.47	C. D. Leet.	Specimen	41d
291	11mm	Lefaucheux Rev.	11mm (0.43)	...	..	...	0.75	1.00	0.47	Houllier-Blanchard.	do.	41f
292	9mm	Lefaucheux Rev.									Ord. Memo No. 1	...
293	7mm	Lefaucheux Rev.									do.	...

CENTER-FIRE, INSIDE PRIMER

294	11mm	Perrin Revolver	11mm (0.438)	199 gr.	6	268	0.59	0.98	0.465		Specimen	41g
295	12mm	Rafael Revolver	12mm (0.450)	170	..	214	0.53	0.95	0.455		do.	41h

CARTRIDGE CHECK LIST—*Continued*

RIM-FIRE

No.	Caliber	Model Arm	Bullet: Diameter	Weight	Powder Charge	Total Weight	Chamber Diameter	Length Case	Over-all Length	Remarks	Source of Data	Plate
296	0.58	Allen & Brand B. L. Musket	0.58	275.5	49	501	?	?		3 buck, wad & ball.	Pamphlet	...
297	0.54	Allen & Brand B. L. Rifle	0.54	473	38.1	575	?	?		Conical ball.	do.	...
298	0.52	Spencer Rifled Carbine	0.55	450	40	534	0.88[15]	1.69	0.56	F. A. Mfr.	F. A. Coll.	41v
299	0.52	Spencer Rifled Carbine	0.54	410	40	?	0.91	1.67	0.56	C. T.	H. P. White Co.	41u
300	0.52	Spencer Rifled Carbine	0.54	418	40	526	0.91	1.67	0.56	"Navy & Inf. Size."	Standish	41x
301	0.52	Spencer & Joslyn Carbines	0.54	433	45	549	0.56	0.886	1.67	C. D. L.	Standish	...
302	0.50	Spencer, M1865	0.52	350	45	?	...	1.16	1.56	C. D. L.	H. P. White Co.	41s
303	0.44	Spencer light Carbine	0.46	?	?	437	0.56	0.91	1.68	F. V. V. & Co.	Specimen	41j
304	0.54	O. M. Ballard Carbine (1863)	0.54	427	53.6	565	0.57	1.22	1.70	Linen Patch on base ball.	H. P. White Co.	41t
305	0.44	Ballard Rifle	0.45	?	?	334	0.46	1.18	2.0		Ord. Memo No. 1	...
306	0.42	Ballard Carbine, M1864	0.44	205	25	?	0.44	0.97	1.53	Smith & Wesson.	F. A. Coll.	41l
307	0.54	Joslyn Carbine M1863	0.541	...	..	539	0.56	0.88	1.44		Specimen	41y
308	0.52	Sharps & Hankins Carbine	0.54	...	45	545	0.56	1.03	1.76	Base patch.	Pitman	41bb
309	0.52	Sharps & Hankins Carbine	0.54	450	45	541	0.56	1.15	1.67	Base, blunt ball.	Specimen	...
310	0.52	Sharps & Hankins Rifle	0.555	465	55	584	0.56	1.16	1.76	Base, blunt ball.	Standish	...
311	0.52	Sharps & Hankins Rifle	0.55	?	..	575	0.56	1.17	1.76		Specimen	41z
312	0.52	Starr Carbine, "New Model"	0.54	?	?	?	0.57	?	?	No. 56 Spencer will chamber.	Ord. Memo No. 1	...
313	0.50	Ball Carbine	0.52	?	?	387	0.56	0.88	1.13		Specimen	41r
314	0.50	Warner Carbine	0.515[16]	?	?	?	0.52	0.75	1.56		Ord. Memo No. 1	...
315	0.46	Remington Carbine	0.46	296	41.5	404	0.461	1.12	1.87	C. T.	Standish	41q
316	0.44	Johnson Carbine	0.45	?	?	?	0.46	?	?	Arm unidentified.	Ord. Memo No. 1	...
317	0.44	Henry Carbine	0.46	?	?	?	0.46	?	?		do.	...
318	0.42	Henry Rifle	0.44	216	25	295	0.44	0.85	?	Navy Tests, 1862.	Report of tests	...
319	0.42	Henry Rifle	0.44	210	30	297	0.44	0.85	1.35	New Haven Arms Co.	Standish	41n
320	0.42	Henry Rifle	0.445	?	?	318	0.44	0.82	1.33	Blunt bullet.	C. W. attributed specimen	41m
321	0.44	Hammond Pistol	0.425	230	20	319	0.44	0.43	1.21		Specimen	41l
322	0.42	Remington Carbine M1864	0.43	?	?	?	0.44	1.13	1.97		Ord. Memo No. 1	...
323	0.41	Ball or Palmer Carbine	0.44	?	?	?	0.44	1.00	1.63	Later ('65) models used Spencer ammo.	do.	41o

[15] Other makes have case of 0.85 and 1.01 inches.
[16] Pitman gives ball diam. of 0.53.

324	0.36	Prescott Navy Revolver	0.385	120	18	175	0.385	0.875	1.28	Similar to No. 62 Allen Rifle; C. & T.	Specimen	41c
325	0.32	Smith & Wesson Revolver	0.32	83.3	13.3	117.5	0.34	0.587	0.99	No. 2 S. & W.	Standish	41b
326	0.22	S. & W. Revolver	0.225	...	..	38.5	0.22	0.42	0.67	No. 1 S. & W.	Specimen	41a

No.	Caliber		Bullet Diameter	Bullet Weight	Powder Charge	Total Weight	Case Length	Total Length	Remarks	Source of Data	Plate
327	1-inch	Gatling RF	0.98	8-oz.	¾-oz.	...	2.15	3.62	FA 1865.	Specimen; Ord. Memo No. 14	42d
328	0.69	Maynard	0.68	...	70	977	1.25	1.56	Conversion 1857 trials.	Specimen	43b
329	0.69	Maynard	0.68	...	70	799	1.28	1.81	Same.	do.	43c
330	0.58	Allin RF	0.58	...	..	...	1.19	1.75	M1865 Springfield.	F. A. Coll. No. 120	41cc
331	0.58	Gatling RF	0.585	565	85	770	1.35	2.16	CW trials, Field gun.	Specimen	42f
332	0.58	Gatling RF	0.58	565	60	715	0.99	1.78	No record US use, Mountain gun.	do.	...
333	0.58	Maynard	0.58	...	60	...	1.41	2.00	1863 Trials.	do.	43h
334	0.58	Meigs	0.61	525	60	725	1.25	1.85	1863 Trials.	do.	43l
335	0.58	Montstorm	0.61	480	60	...	1.21	1.92	Conversion 1858-60.	do.	43m
336	0.58	Schubarth	0.61	551	70	764	1.13	2.0	Conversion Gallager & Gladding Pat.	do.	43f
337	0.54	Morse carbine	0.55	?	50	728	1.44	2.06	1857 Trials, cast case.	do.	43a
338	0.50	Pistol, IP	0.50	...	..	...	0.95	1.45	Springfield 1865.	F. A. Coll. No. 311	43p
339	0.50	Foil, IP	0.52	343	40	444	1.13	1.86	FA 1865.	Specimen	43k
340	0.50	RF BN	0.50	500	55	...	1.50	1.88	Springfield 1865.	F. A. Coll. No. 130	...
341	0.50	RF	0.50	400	60	...	1.25	2.13	Same.	do. No. 131	43r
342	0.44	RF	0.45	...	..	...	1.62	1.92	Williams bullet.	Specimen	43o
343	0.44	RF BN	0.44	350	45	...	1.13	2.00	Springfield 1865.	F. A. Coll. No. 126	43v
344	0.44	RF BN	0.44	350	40	...	0.88	1.72	Same.	do. No. 128	43s
345	0.44	RF BN	0.44	300	40	...	1.05	1.75	Same.	do. No. 127	43u
346	0.44	RF BN	0.44	300	40	...	0.94	1.65	Springfield 1865, interchanges with No. 303.	F. A. Coll. No. 129	43t
347	0.44	RF	0.44	500	45	...	1.44	2.50	Same.	do. No. 125	43w
348	0.42	RF	0.42	140	50	240	1.68	2.17	Williams bullet.	Specimen	43n
349	0.38	Sharps rifle	0.39	140	22	231	1.08	1.56	Soldered tab extractor, 1857 Trials.	do.	43d
350	0.36	Sharps rifle	0.37	137	20	255	1.12	1.57	Keystone extractor, variant.	do.	43e
351	0.36	Cofer rev.	0.38	115	18	246	1.53	1.97	CSA pat.	do.	42g

APPENDIX 1

DIGEST OF CARTRIDGES

(For Small Arms)

PATENTED IN THE UNITED STATES

PRIOR TO FEBRUARY 1, 1878.

5,699.—W. Hunt, Aug. 10, 1848. Reissued Feb. 26, 1850, No. 163. Wooden case extending into annular groove in base of bullet. Perforation in base stopped by a bit of cotton.

5,701.—W. Hunt, Aug. 10, 1848. Reissued Feb. 26, 1850, No. 164. Powder in base of projectile covered by metal cap.

7,147.—A. D. Perry, March 5, 1850. Powder in projectile secured by wad of gun cotton.

8,956.—Marston and Goodell, May 18, 1852. Shell of paper or metal, with leather or paper base.

11,496.—Smith and Wesson, August 8, 1854. Copper shell, with metal disk near base to serve as anvil, and metal disk back of bullet to hold tallow next the ball.

11,870.—D. Moore, October 31, 1854. Concave base.

12,545.—A. R. Davis, March 20, 1855. Shot mixed with clay, and inclosed in loosely felted case.

12,556.—A N. Newton, March 20, 1855. Priming in rod extending back from bullet.

14,147.—Smith and Wesson, January 22, 1856. Priming in copper cup, having steel disk or anvil, placed in base of bullet.

14,491.—A. E. Burnside, March 25, 1856. Reissued March 10, 1863, No. 1,428. Metallic. Perforation closed with paper or foil.

15,141.—Edw. Maynard, June 17, 1856. Reissued May 28, 1861, No. 1,191. Metal shell; rear aperture closed by waxed paper. Bullet lubricated.

15,369.—Buckle and Dorsch, July 22, 1856. Paper case.

15,707.—J. Riedel, September 9, 1856. Shot cartridge, conical paper case, with base of sheet lead.

15,996.—Geo. W. Morse, October 28, 1856. Soft metal shell, with hard metal disk attached to base by projections on the soft metal, by copper eylet, or by pressing into the soft metal. May have priming between shell and disk, and internal anvil.

17,287.—Edw. Lindner, May 12, 1857. Case of thin brass covered with paper, or of paper alone.

17,702.—G. Smith, June 30, 1857. Reissued Sept 14, 1858, No. 598. Case of vulcanized rubber or rubber cloth.

17,792.—W. B. Johns, July 14, 1857. Leaden base, pasteboard tube, and felt wad above shot, all covered by paper case.

18,143.—J. D. Greene, Sept. 8, 1857. Bullet at rear of cartridge.

18,217.—L. Wells, Sept. 15, 1857. Hard metal tube forms shell. Cap on anvil extending back from bullet, and in hole in leather wad closing rear of the tube.

20,214.—Geo. W. Morse, May 11, 1858. Metal tube has pronged anvil soldered inside. Base closed by cup, which is driven against cap on anvil by hammer in firing.

20,727.—Geo. W. Morse, June 29, 1858. Cap on anvil in base of metal tube, surrounded by perforated rubber disk.

21,253.—Gomez and Mills, Aug 24, 1858. Explosive substance separated into layers by coil of paper, and placed in paper case wound with thread.

22,565.—Edw. Maynard, Jan. 11, 1859. Reissued May 28, 1861, No. 1,192. Perforated steel disk soldered to perforated base of brass shell.

24,548.—J. H. Ferguson, June 28, 1859. Inflammable paper case, varnished externally. (No drawing.)

24,726.—Ellis and White, July 12, 1859. Reissued Aug. 25, 1863. No. 1,529. Metal shell with rim in front, and annular projection from rear containing fulminate.

27,791.—Geo. P. Foster, April 10, 1860. Burnside cartridge, with grease chamber around bullet.

27,933.—Smith and Wesson, April 17, 1860. Reissued June 4, 1867. No. 2,636. Fulminate in rim, surrounding perforated base wad.

29,108.—C. Sharps, July 10, 1860. Reissued April 21, 1863. No. 1,455. Metallic, rim fire.

29,287.—J. P. Lindsay, July 24, 1860. Long metal tube containing several charges one above another. Separate firing pins in tube at side explode the charges in their proper succession.

30,109.—E. Allen, Sept. 25, 1860. Metallic. Side teat for fulminate.

31,815.—C. A. McEvoy, March 26, 1861. Metal tube, open at both ends contains charge, which is held in by outside envelope, and pushed out of tube by ramrod.

32,345.—R. Bartholow, May 21, 1861. Nitrate of potass, charcoal, sulphur, and chlorate of potassa mixed with shellac, pressed into form of cartridge, and coated with collodion. (No drawing.)

32,949.—Edw. Lindner, July 30, 1861. Reissued Feb 17, 1863, No. 1,411. Stopper of yarn or roving in base of paper case.

33,393.—Johnston and Dow, Oct. 1, 1861. Case of gun cotton, which may be coated with collodion. (No drawing.)

33,429.—R. C. English, Oct. 8, 1861. Rubber case with metal bushing at base.

33,481.—J. P. Gillespie, Oct 15, 1861. Metallic, tapered, with nipple at base, and internal points to hold bullet.

33,611.—W. Mont Storm, Oct. 29, 1861. Case made of intestines, coated with gutta percha varnish. (No drawing.)

33,805.—R. White, Nov. 26, 1861. Reissued Feb. 8, 1870. No. 300. Metallic, separate loose internal tube in front of bullet serves as gas check between cylinder and barrel of revolver. Base cup has plugs and small central aperture, and is reinforced by external disk with larger aperture, which contains cap.

34,061.—Johnston and Dow, Jan. 7, 1862. Case of gun-cotton, coated with collodion. (No drawing.)

34,367.—J. Hotchkiss, Feb. 11, 1862. Layers of gut, wound spirally in opposite directions.

34,579.—B. King, March 4 1862. Case of gut, with metal base, having tangential nipple for cap.

34,615.—A. Shannon, March 4, 1862. Case of gut, divided into sections by perforated wads.

34,713.—E. C. Dunning, March 18, 1862. Like McEvoy, 31,815.

34,725.—Doremus and Budd, March 18, 1862. Powder pressed in a cake upon pin, or into base of bullet. Powder may be in layers of varying combustibility, so as to be accelerating. (No drawing.)

34,744.—Doremus and Budd, March 25, 1862. Same as preceding, coated with collodion. (No drawing.)

34,806.—B. L. Budd, March 25, 1862. Reissued April 2, 1872. No. 4,843. Shot placed in mold, and tallow or wax cast over them. Cartridge may have end wads.

34,854.—S. W. Wood, April 1, 1862. Drawn metal shell, tapered.

34,987.—C. Sharps, April 15, 1862. Drawn metal shell, with thick base containing fulminate and pin.

35,687.—Johnston and Dow, June 24, 1862. Case coated with collodion. (No drawing.)

35,699.—J. C. Mayberry, June 24, 1862. Paper case, turned in at base over disk having projecting pin.

35,872.—W. H. Elliot, July 15, 1862. Reissued Sept. 23, 1873. No. 5,577. Copper shell, bullet patched with fabric.

35,878.—H. Kellogg, July 15, 1862. Reissued March 27, 1877. No. 7,569. Metallic shell, with rear projecting teat to be cut off by breech-block in loading. Interior of shell varnished with collodion.

35,949.—E. O. Potter, July 22, 1862. Pressed powder, coated with collodion; united to bullet by belt of collodion.

36,066.—R. Bartholow, Aug. 5, 1862. Collodion mixed with gunpowder and molded into cartridge. (No drawing.)

36,108.—W. R. Pomeroy, Aug. 5, 1862. Outside paper tube pulls off from inside paper case, instead of being torn off.

37,481.—C. R. Alsop, Jan. 27, 1863. Case of gut or rubber. Wad over shot held in by shellac.

37,491.—L. B. Bruen, Jan 27, 1863. Shot case of muslin or paper dipped in collodion, with wads cemented to ends.

38,322.—W. E. Moore, April 28, 1863. Metallic shell tapered to base, and having weak points to be ruptured by explosion.

38,414.—E. K. Root, May 5, 1863. Metallic. Front end of shell turned in over shot.

39,109.—W. Bakewell, July 7, 1863. Shell polygonal in cross section, with round base and nipple.

39,823.—Edw. Maynard, Sept. 8, 1863. Cap attached to metallic shell by an arm or cord.

39,869.—J. H. Vickers, Sept. 8, 1863. Outside tube, as thick as the flange, applied loosely over front of metallic cartridge.

39,915.—A. Hall, Sept. 15, 1863. Metallic shell, closed next to bullet, and slightly attached thereto, so as to accompany bullet a short distance when fired.

40,092.—W. H. Dibble, Sept. 29, 1863 Hollow projectile extended to form shell, covered with gut, and may be rifled externally.

40,111.—Edw. Maynard, Sept. 29, 1863. Tongues at front end of metallic shell turned in over wad.

40,112.—Edw. Maynar l, Sept. 29, 1863. Metallic, with cord or wire attached, to extract shell when fired.

40,490.—W. W. Marston, Nov. 3, 1863. Metallic, with separate teat extending through base. Fulminate varnished.

40,761 —O. D. Lull, Dec. 1, 1863. Metallic. Cruciform patch turned over base of shell.

40,978.—S. Crispin, Dec. 15, 1863. Shell of thin wrapped sheet-metal, or sheet metal and paper, turned over metal disk at base.

40,988.—Rodman and Crispin, Dec. 15, 1863. Shell of wrapped sheet-metal, with base crimped in and reinforced.

41,183.—D. Williamson, Jan. 5, 1864. Metallic. Flat teat for fulminate at base.

41,590.—E. G. Allen, Feb. 16, 1864. Metallic. Wad between powder and ball.

41,684.—G. Conover, Feb. 23, 1864. Metallic. Small supplementary charge at rear to throw out shell.

42,329.—S. Crispin, April 12, 1864. Thin metal and paper rolled together, and reinforced at base.

42,388.—Edw. Maynard, April 19, 1864. Cup-shaped metal wad between powder and shot.

42,666.—Johnston and Dow, May 10, 1864. Fulminate between flanged tube and base cup.

42,667.—Johnston and Dow, May 10, 1864. Primer for base of preceding cartridge.

42,668.—Johnston and Dow, May 10, 1864. Case of paper saturated with paraffine, wax, glue, or oil. (No drawing.)

42,815.—C. J. Bergen, May 17, 1864. Double metallic shell, with channels between tubes to ignite powder at front end.

43,851.—J. C. Howe, Aug. 16, 1864. Copper shell. Perforated diaphram between fulminate and powder. Grooves in shell to engage extractor.

44,660.—E. K. Root, Oct. 11, 1864. Metallic. Fulminate in radial slots of short cylinder, or between sectors.

44,692.—C. E. Sneider, Oct. 11, 1864. Thin metal shell, crimped around bullet. Cap in base of bullet, fired by pin.

45,079.—E. K. Root, Nov. 15, 1864. Cylindricial anvil surrounded by fulminate in projecting teat.

45,210.—C. E. Sneider, Nov. 22, 1864. Case of paper or metal, having external metal cap secured by bayonet fastenings.

45,292.—W H. Wills, Nov. 29, 1864. Metallic. Screw-cap on base.

45,319.—J. M. Cooper, Dec. 6, 1864 Base of shell extended to form nipple.

45,420.—Edw. Maynard, Dec. 13, 1864. Metallic, with annular paper wad in base to support fulminate tube and extracting cord.

45,666.—T. Yates, Dec. 27, 1864. Internal tube contains fulminate near base of projectile, and spring valve for closing vent.

45,830.—S. Jackson, Jan. 10, 1865. Shell inclosed in paper or fabric case.

46,034.—H. C. Spaulding, Jan. 24, 1865. Metallic. Coated internally with collodion.

46,292 —H. Berdan, Feb. 7, 1865. Coiled paper case, with metal base cup. The case and projectile made to fit rifling.

47,317.—D. M. Mefford, April 18, 1865. Light wooden tube contains shot and powder, and has a time fuse and binding cord.

47,688.—E. Allen, May 16, 1865. Reissued May, 1877. No. 7,647. Brass shell with steel base brazed inside. Front of shell screw-threaded or roughened internally.

48,536 —W. C. Dodge, July 4, 1865. Reissued July 13, 1869. No. 3,548. Metallic. Coated with tin or electroplated internally.

48,820.—E. Martin, July 18, 1865. Concave base. Fulminate inclosed in glass cup.

49,237.—S. Crispin, Aug. 8, 1865. Fulminate in annular recess surrounding tube.

50,536.—T. J. Powers, Oct. 17, 1865. Reissued Sept 14, 1869. No 3,638. Separate metallic shells for powder and shot. Shot case is bent from a blank of star form, and enters slightly into powder case.

50,592.—Jackson and Pusey, Oct. 24, 1865. Metallic disk in base of shell has fulminate in central aperture.

51,243.—W. Tibbals, Nov. 28, 1865. Internal anvil with nipple rests loosely against perforated base of shell.

51,324.—T. T. S. Laidley, Dec. 5, 1865. Sheet-metal anvil, as wide as internal diameter of shell, has legs extending forward against bullet.

52,370.—J. W. Smith, Jan. 30, 1866. Paper case. Internal tube of wire gauze.

52,818.—H. Berdan, Feb. 27, 1866. Cavity for fulminate in base of pin extending back from bullet.

53,168.—A. Moffatt, March 13, 1866. Reissued July 19, 1870, Nos. 4,075, 4,076. Disk anvil of metal, pasteboard, or pressed powder. Has fulminate at center and around rim.

53,388.—H. Berdan, March 20, 1866. Outside cap sunk below surface of head of shell.

53,490.—W. H. Risley, March 27, 1866. Metallic tube (or charger) has central diaphragm to separate powder and shot charges, which are held in by end wads. The wads are forced out by diagonal pin or string, to pour charge into muzzle of gun.

53,501.—T. L. Sturtevant, March 27, 1866. Cap on pin inserted at side. Base of charge-chamber made conical.

54,038.—T. L. Sturtevant, April 17, 1866. Pin fire. Shoulder on pin serves as valve to close vent.

55,233.—A. S. Blake, June 5, 1866. Fulminate between base cup and shell proper. The shell is expanded into recess in cup when fired, to secure the two together.

55,552.—T. L. Sturtevant, June 12, 1866. Charge-chamber has trumpet shaped breech. Nipple screwed into side of shell.

55,676.—T. T. S. Laidley, June 19, 1866. Anvil of sheet metal diametrically across internal base of shell, secured by reducing shell in front of anvil.

58,800.—G. A. Fitch, Oct. 16, 1866. Fulminate in front of pin extending from bullet to base of shell, or between two pins. Quick and slow burning powder to make accelerating charge.

59,044.—Edw. Maynard, Oct. 23, 1866. Shell soldered to perforated disk at base, with fulminate in perforation covered by metal cap.

60,814.—O. F. Winchester, Jan. 1, 1867. Rubber washer between metal tube and base cup. Fulminate in recess at base of tube.

61,225.—Edw. Maynard, Jan. 15, 1867. Fulminate inside of detachable base cup.

62,283.—I. M. Milbank, Feb. 19, 1867. Reissued Aug. 6, 1867. No 2,716. Metallic, with internal reinforce at base. Detachable priming tube extends into center of charge.

62,466.—A. J. Bergen, Feb. 26, 1867. Tubular shell turned over edge of primed base.

62,467.—A. J. Bergen, Feb. 26, 1867. External cap fits into recess in base.

65,774.—D. Smith, June 11, 1867. Anvil secured by turning down internal annular projection from head over edge of anvil

68,960. J. F. Cranston, Sept. 17, 1867. Legs of U-shaped anvil rest against annular internal projection of shell.

69,707.—J. Rupertus, Oct. 8, 1867. Bullet perforated longitudinally. Powder in front of bullet fired through the perforation, and expels bullet left behind at preceding discharge.

70,612.—J. Rider, Nov. 5, 1867. Steel base screwed into copper shell.

72,982.—T. Cullen, Jan 7, 1868. Paper case turned in at rear, and secured between internal washer and external cup by nipple screwed through both.

73,739 —H. Meigs, Jr., Jan. 28, 1868 Concave slotted disk of tinned iron has recess for fulminate in concave side; this is put into copper shell from front, and expanded by pressure to form anvil.

73,877.—J. F. Cranston, Jan. 28, 1868. External recess in perforated base contains fulminate, which is covered by disk secured by crimping metal over the edges.

75,019.—W. O. Howard, March 3, 1868. Shot in tube of fabric stiffened by coating of paraffine. This may be used in common metallic shell.

78,337.—W. Tibbals, May 26, 1868. Metallic disk anvil secured in flange by drawing down the shell after anvil is put in.

78,953.—R. J. Gatling, June 16, 1868. Cap between base of shell and internal perforated cup, or reinforce.

81,058.—B. Burton, Aug. 11, 1868. Priming disks of fabric coated with phosphorus and chlorate potash, separated by washer, are placed at base of bullet, and fired by pin projecting from base.

81,478.—J. F. Cranston, Aug. 25, 1868. Annular crimp to retain anvil.

82,587.—H. Berdan, Sept. 29, 1868. Reissued Aug. 1, 1871. No 4,491. Internal reinforce cup fits loosely into shell, but tightly around turned in portion of head. Patched bullet. Exterior priming cap

83,434.—Abraham & Bayliss, Oct. 7, 1868. Shell has longitudinal and diagonal incisions. May be lined with thin metal.

85,482.—W. Schmitz, Dec. 29, 1868. Cylinder of rolled paper drilled out to hold explosive compound at one end, and hollowed to fit bullet at the other end, all covered with varnished paper. (No drawing.)

87,125.—W. Tibbals, Feb. 23, 1869. Concave perforated disk anvil put into shell from front, and flattened down over fulminate to enter flange.

87,297.—B. S. Roberts, Feb. 23, 1869. Anvil secured as in preceding case, and shell afterward tapered.

87,352.—J. V. Meigs, March 2, 1869. Fulminate surrounds or crosses depressed portion in base of shell, making indented portion serve as anvil.

87,735.—J. R. Van Vechten, March 9, 1869. Fulminate between sheets of paper, secured between shell and internal reinforce by shellac.

87,990.—G. H Todd, March 16, 1869. Tube in base contains cap and firing-pin.

88,191.—E. Martin, March 23, 1869. Priming cup struck up from base of shell, which may be reinforced.

88,202.—W. F. Parker, March 23, 1869. Base recessed around head of cap.

88,948.—A. B. Ely, April 13, 1869—Cases molded from pyroxyline. (No drawing.)

89,563.—G. H. Daw, May 4, 1869. Tube of sheet-metal rolled up and soldered at edges, with rear end crimped into base cup. Wad of pulp in base.

90,607.—W. Tibbals, May 25, 1869. Internal reinforce for base of shell.

90,931.—J. V. Meigs, June 8, 1869. Fulminate in bar anvil over groove in base.

91,278.—D. Smith, June 15, 1869. Annulus in center of base turned down over external primer.

91,668.—W. Richards, June 22, 1869. Priming chamber extends inward from base, and is expanded over internal reinforce. Separate head and base wad may be attached in same way.

91,818.—E. M. Boxer, June 29, 1869. Rear end of tube turned in between wad and base disk, and secured by priming tube acting as a rivet. Edges of cap rest on shoulder on anvil

92,136.—D. Williamson, June 29, 1869. Rear teat softened.

92,795.—J. J. Chaudun, July 20, 1869. Anvil serves as pin for removing the cap.

93,545.—I. M. Milbank, Aug. 10, 1869. Internal cup, which serves as reinforce and anvil, is soldered to base, or secured by varnish.

93,546.—I. M. Milbank, Aug. 10, 1869. Base strengthened by solder run in around priming tube.

94,210.—B. B. Hotchkiss, Aug. 31, 1869. Solid flange, with rounded interior corner. Base recessed for cap.

96,373.—F. Wohlgemuth, Nov. 2, 1869. Metallic base cup screwed into or upon tube.

97,537.—Logan and Eldridge, Dec. 7, 1869. Shell crimped into groove in metallic base piece.

97,615.—Depew and Slatcher, Dec. 7, 1869. Brass or copper tube with steel base, and with lining of metal heavier at base than outside tube.

97,653.—C. W. Lancaster, Dec. 7, 1869. Paper case, heavy at base, with external metal reinforce and flange; cup-shaped wad at one or both ends of shot charge to prevent scattering.

97,843.—R. Whit , Dec. 14, 1869. Fulminate paste mixed with paste of dissolved india rubber.

98,278.—Leet and Hotchkiss, Dec. 28, 1869. Internal cap; tube which contains cap and anvil is surrounded by coiled or compressed paper.

98,439.—W. H. Smith, Dec. 28, 1869. Recess around nipple has openings into chamber surrounding nipple inside of shell.

98,995.—S. Newhouse, Jan. 18, 1870. Anvil serves as pin for removing cap. Front of priming chamber has diagonal perforations.

99,078.—E. Gomez, Jan. 25, 1870. Explosive material between layers of paper wound on pin extending back from bullet, and bound with fine wire.

99,079.—E. Gomez, Jan. 25, 1870. Quick burning fuse wound spirally around pin extending back from bullet. Spiral side vent acts as rocket to give rotary motion to cartridge in smooth bore gun.

99,528.—F. E. Boyd, Feb. 8, 1870. Metallic tube, with head, washer, and nipple screwed therein. Washer of brass or steel.

99,666.—E. Gomez, Feb. 8, 1870. Metallic. Explosive material between layers of paper rolled up to leave recess in front, which receives projection at base of bullet.

99,721.—W. H. Smith, Feb. 8, 1870. Pin fire. Radial opening in base closed by screw.

102,051.—O. Schevenell, April 19, 1870. Case made of staves of wood, glued together, having end disks glued on. Staves are uneven at ends, to break apart when struck by ramrod.

102,109.—A. N. C. Gavard, April 19, 1870. Steel tube, rolled with an oblique joint and unsoldered, turned into annular groove in copper base plug.

102,675.—R. J. Gatling, May 3, 1870. Soild rim having internal teat surrounded by solder.

102,984.—C. E. Sneider, May 10, 1870. Pasteboard case, with flanged metallic base cup.

103,079.—T. J. Powers, May 17, 1870. Pasteboard tube, turned in over base wad of wound paper.

104,912.—N. G. Whitmore, June 28, 1870. Transverse passage through base for insertion of flat primers.

105,348.—E. Martin, July 12, 1870. Steel or iron base. Shell filled in around internal projection with graphite.

108,543.—D. E. Williams, Oct. 18, 1870. Reissued July 3, 1877. No. 7,783. Pasteboard case, metallic base Conical chamber formed by winding triangular piece of paper upon itself, leaving space for cap at center.

109,931—W. I. Page, Dec. 6, 1870. Shell corrugated. Front end turned in behind bullet, so as to be fired out of gun. Fulminate in annular rear projection.

110,264.—R. R. Moffatt, Dec 20, 1870. Paper case treated with oxidized carbolic acid dissolved in wood spirits, so as to be combustible. Metallic base.

110,265.—R. R Moffatt, Dec. 20, 1870. Fulminate pocket has roughened faces or corrugations.

110,383.—R. R. Moffatt, Dec. 20, 1870. Shot case made combustible.

110,881.—R. White, Jan. 10, 1871. Double paper case with metallic base. Case torn apart by explosion, and one part serves as patch for ball.

111,377.—S. W. Paine, Jan. 31, 1871. Shot case of flat staves hinged together at rear. Binding disks of muslin between layers of shot.

111,856.—E. Martin, Feb. 14, 1871. Head of shell folded down to secure anvil. Reinforcing cup may be held by crimping shell above it.

112,305.—R. White, Feb. 28, 1871. Cap and shell tongued and grooved one into the other.

113,634.—S. Crispin, April 11, 1871. Base disk having priming chamber is soldered to base cup. Tube of metal, paper, or muslin.

113,677.—C. W. Lovett, Jr., April 11, 1871. Shot inclosed in coil consisting of two or more spirals of wire, surrounded by case of paper or muslin. Powdered chalk or tripoli mixed with shot.

115,498.—I. M. Milbank, May 30, 1871. Bullet inclosed in case of wood, having front scraping edge. Slow and quick burning powder separated by paper diaphragm.

115,548.—C. S. Wells, May 30, 1871. Thin metal lap jointed outside shell, lined with paper pulp, and having internal metal reinforce.

115,892.—T. J. Powers, June 13, 1871. External metal cup turned over flange of shell.

116,094.—T. J. Powers, June 20, 1871. Metallic; flanged priming cup in base.

116,105.—W. S. Smoot, June 20, 1871. Projection at base of shell passes through washer, and is riveted thereto.

116,640.—C. E. Sneider, July 4, 1871. Separate paper cups contain powder and shot. The two cases may be in metal shell, or joined by metal or paper band.

117,173.—A. C. Hobbs, July 18, 1871, Solid disk and anvil cup secured to base of shell by metallic washer.

117,388.—J. S. Crary, July 25, 1871. Internal concentric shell divides powder into two portions. One portion or charge is quick and the other slow burning powder.

119,357.—A. C. Hobbs, Sept. 26, 1871. Blank cartridge. Rubber disk in base to receive blow of hammer. Bullet may be of wood or bone.

120,323.—G. R. Pierce, Oct, 24, 1871. Closing cup is placed in recess in base over cap. Anvil secured by inside nut or washer, and serves as pin to remove cap.

120,338.—W. S. Smoot, Oct 24, 1871. Base reinforced by disk of cold lead pressed into flange.

120,403.—G. R. Stetson, Oct. 31, 1871. Bullet swaged after being placed in shell.

120,529.—A. Payne, Oct. 31, 1871. Portion of the metal of the shell swaged down over edges of anvil.

120,625.—J. W. Cochran, Nov. 7, 1871. Reinforce cup held in by slightly indenting the shell.

120,630.—C. F. and J. E. De Dartein, Nov. 7, 1871. Cup at forward end of shell, to form gas-check between cylinder and barrel of revolver.

120,990.—H. Metcalfe, Nov. 14, 1871. Shell has recess in base, smaller than flattened end of bullet, so that bullet will not explode next cartridge in magazine

121,606.—Forehand and Wadsworth, Dec. 5, 1871. Paper case, with metallic head.

121,808.—A. Payne, Dec. 12, 1871. Metal from inside of shell punched down to form reinforce to head.

122,399.—I. M. Milbank, Jan. 2, 1872. Shell of zinc, soldered to base disk.

122,504.—C. S. Wells, Jan. 2, 1872. Paper tube inside of thin metal shell, which is soldered to base disk.

123,351.—I. M. Milbank, Feb. 6, 1872. Annular flange soldered to outside of shell, and reinforcing washer soldered inside. Bullet in wooden case, having outside groove for lubricant.

123,352.—I. M. Milbank, Feb. 6, 1872. Paper case waterproofed with soluble glass, reduced at rear end to enter metallic base cup. The soluble glass forms a cement to hold cup and tube together.

123,622.—G. H. Dupee, Feb. 13, 1872. Base of shell thickened, and has annular groove in front of flange, which is of same diameter as body of shell.

125,830.—I. M. Milbank, April 16, 1872. Dovetailed projection at base of shell secures flanged disk and contains fulminate.

126,058.—W. W. Hubbell, April 23, 1872. Bullet in a case or sabot of paper mache.

127,308.—J. W. Cochran, May 28, 1872. Wad of pressed cork, rolled in powdered graphite, placed at base of bullet.

130,679.—N. G. Whitmore, Aug. 20, 1872. Shell has metallic base cup with external recess, which contains chambered disk or cup to expand laterally on the explosion of the cap.

131,016.—I. M. Milbank, Sept. 3, 1872. Annular flange retained by swell in shell. Lubricating rings around bullet in front of wooden sabot.

131,017.—I. M. Milbank, Sept. 3, 1872. Metallic base flange or cup secured by priming cup riveted through head.

131,018.—I. M. Milbank, Sept. 3, 1872. Base has circular flanged edge, and is secured to shell by hollow teat.

131,104.—A. D. Laws, Sept. 3, 1872. Annular corrugations in tube of shot cartridge to retain wad.

131,180.—C. E. Sneider, Sept. 10, 1872. Strips or wires pass around top and bottom wads of shot cartridge inside shell.

132,227.—S. W. Wood, Oct. 15, 1872. Shell cast of ductile metal and then drawn to shape.

134,048—P. Giffard, Dec. 17, 1872. Shell has spring valve opening inwardly and is charged with compressed air or liquefied gas.

134,368.—De W. C. Farrington, Dec. 31, 1872. Lubricant around front of bullet, with shell turned in over the same.

136,130.—B. Burton, Feb. 25, 1873. Rounded base, with groove in front of flange, which is of same diameter as body of shell.

136,168.—I. M. Milbank, Feb. 25, 1873. Shell of tinned sheet iron, rolled up and the edges soldered together. End of tube turned out to form flange, and base cup soldered in.

136,336.—S. W. Payne, Feb. 25, 1873. Reissued Nov, 10, 1874. No. 6,130, Shot cartridge made of divided shell of sheet metal bound together by thread.

136,468.—W. H. Tooth, March 4, 1873. Shell of fusible metal, or of inflammable metal. Lead and tin, or tin, zinc, and bismuth. (No drawing.)

138,679.—Mott and Gardiner, May 6, 1873. Insulated wire extending from rubber disk in base of shell nearly to fulminate in base of bullet, so that cartridge may be fired by electricity.

140,144.—T. T. S. Laidley, June 24, 1873. Powder pressed into shell. Longitudinal passage through center of powder.

142,924.—Logan and Hart, Sept. 16, 1873. Brass shell. Base cast or formed in dies.

144,010.—S. W. Wood, Oct. 28, 1873. Shell formed by electro-deposition.

144,011.—S. W. Wood, Oct. 28, 1873. Paper case covered with metal, electro deposited thereon.

144,012.—S. W. Wood, Oct. 28, 1873. Hard metal base or shell, (copper or brass,) electroplated with nickel or other metal.

148,467.—A. B. Kay, March 10, 1874. Shot cartridge. Shell of flexible material turned in at front over wad.

151,121.—Hart and Logan, May 19, 1874. Ring surrounding primer.

151,327.—C. Weldon, May 26, 1874. Shot in two or more tubes of strong paper, separated by wads, all inclosed in shell.

151,396.—E. Jones, May 26, 1874. Paper case, reinforce, and base, held together by metallic base ring.

152,428.—W. S. Smoot, June 23, 1874. Internal cup pressed down over base wad. Where cup extends whole length of tube, outer shell may be of zinc.

155,841.—J. Orcutt, Oct. 13, 1874. Annular groove in reinforce between cup and shell, to serve as gas check.

157,793.—J. W. Cochran, Dec. 15, 1874. Paper shot case attached to double concave wad, closed by front wad. The whole inclosed in shell.

157,916.—B. B. Hotchkiss, Dec 22, 1874. Base disk has projection which passes through shell, and is riveted down inside. May have additional rivets or screws.

158,494.—B. B. Hotchkiss, Jan. 5, 1875. Tube of tinned iron turned in at base, reinforced with one, two, or more cups, and solid base disk, all riveted together. The inside cup is pressed in over perforation, and is pressed back by the explosion, forming gas check.

159,665.—M. M. E. Gauthey, Feb. 9, 1875. Lap seamed shell, turned in at base between reinforce cups.

159,883.—T. R. Bayliss, Feb. 16, 1875. Shell drawn mouth forward through dies, by which metal at base is increased in thickness.

160,263.—DeW. C. Farrington, March 2, 1875. Metal of projectile turned over end of shell.

160,763.—F. W. Freund, March 16, 1875. Steel shell, with thick base, which may screw into tube, or form part of the same.

161,514.—N. C. Hunting, March 30, 1875. Sheet metal tube, open at both ends. Base disk has rubber disk and nipple passing through it.

162,901.—E J. Collett, May 4, 1875. Shell divided by disks, having flanges or wings to support the disks and divide the charge, so that successive portions may be ignited. Pin from base of cartridge ignites fulminate at base of bullet.

163,154.—R. F. Cook, May 11, 1875. Outer open ended shell surrounds bullet and patch, and extends over inner headed shell which contains charge. In loading, the inner shell pushes the bullet out of the case into the grooves of the barrel.

163,181.—J. H. Gill, May 11, 1875. Shell has slot across bottom of priming cup, with an anvil across this slot.

164,894.—B. D. Wilson, June 22, 1875. Metallic shell having paper lining.

169,806.—G. E. Hart, Nov. 9, 1875. Base piece riveted down on both sides of the head of shell.

169,807 —G. E. Hart, Nov. 9, 1875. Shell turned into annular recess inside of base cap, and secured by a ring above. Anvil of nickel, or other non-corrodible metal.

170,643.—G. Smith, Nov. 30, 1875. Metallic shell, with pasteboard inner case. Concavo-convex metallic disks in tube, the front one of which extends into tube and carries it out of shell when cartridge is fired.

172,382.—L. W. Broadwell, Jan 18, 1876. Tube rolled from thin metal blank, widest at rear, so as to give double thickness to base of cartridge. Base cup strengthened by internal and external disks, and a coiled strip of metal.

172,446.—A. B. & R. A. Kay, Jan. 18, 1876. Perforated or woven metal wad in front of shot.

172,714.—L. T. De Froidville, Jan. 25, 1876. Case of tin foil. Layer of grease behind bullet, covered by metal wad placed between two paper wads,

173,538.—A. Hall, Feb. 15, 1876. Paper shell, with metallic head. Sheet metal anvil diametrically across tube, held by spurs at each end.

175,293.—J. Merwin, March 28, 1876. Conical recess in base.

175,400.—T. Wilkinson, March 28, 1876. Perforated shot strung on wires between two wads.

178,055.—A Hall, May 30, 1876. Paper case. Diametrical anvil, surrounded by socket tube in one piece with anvil, inside case, all covered by metallic base cup.

178,683.—W. S. Smoot. June 13, 1876. Bar anvil secured into priming pocket by pressing down and expanding the ends of anvil.

178,698.—S. W. Wood, June 13, 1876. Paper tube, with rear end turned in between wads. Metallic base cup, having internal screw-threaded projection, screwed into wads. May have metallic disk between paper base wads.

179,634.—R. White, July 4, 1876. Intended to explode by pressure instead of a blow. Shell turned in around projection on bullet. A small charge of powder between bullet and shell blows the two apart at the proper time.

180,510.—Welsh and Evans, Aug. 1, 1876. Tube open at both ends passed over front of flanged base plug, having conical powder chamber.

180,840.—H. C. Bull, Aug. 8, 1876. Perforated tube extending from base of shell through powder to base of bullet.

181,356.—I. M. Milbank, Aug. 22, 1876. Shell drawn from blank of zinc, coated on one or both sides with tin.

181,977.—J. P. Pieri, Sept. 5, 1876. Shell of metal foil and gutta percha rolled up and vulcanized.

185,548.—J. Kinney, Dec. 19, 1876. Points or protuberances inside shell to retain wads in shot cartridge.

186,220.—J. P. White, Jan. 16, 1877. Anvil small enough to receive smallest gun cap. Cup of any size retained on anvil by perforated cover placed over it.

186,391.—J. P. White, Jan. 16, 1877. Concavo-convex wads, on one or both ends of shot charge.

186,460 —H. Buffington, Jan. 23, 1877. Tubular sliding anvil having head at each end passed through perforation in base of shell.

189,069.—A. B. Smith, April 3, 1877. Paper case, wooden base wad. Metal base cup fastened to case by bayonet catch operating on pin passing through base and wad.

189,417.—H. H. Barnard. April 10, 1877. Divided tube for shot held together by short pieces of thread wound thereon, all inclosed in paper case.

190,190.—B. L Budd, May 1, 1877. Shell has internal screw thread to retain wads above and below shot.

190,208.—J. H. Gill, May 1, 1877. Copper shell, cylindrical at front and rear, fluted in middle. Dome-shaped anvil with three or more legs.

191,243.—I. Kinney, May 29, 1877. Paper tube with metal base cup screwed thereon.

191,430.—B. B. Hotchkiss, May 29, 1877. Base of shell turned in and then turned out to form flange.

192,676.—J. H. Bullard, July 3, 1877. Brass body, lined with copper held in by rim projecting into flange.

193,612.—T. T. S. Laidley, July 31, 1877. Hole punched through closed end of tube; projection on cup-shaped head pressed down through hole and riveted down inside. Triangular prismatic anvil.

193,658.—B. B. Hotchkiss, July 31, 1877. Brass shell with external reinforce and disk, and internal reinforce having projection passing through base to secure all together.

193,855.—I. Davis, Aug. 7, 1877. Shell in sections passing over front and rear of dividing plugs which carry cones and percussion caps, to make an accelerating charge.

197,823.—J. H. Bullard, Dec. 4, 1877. Brass shell with copper lining thickened at base, and having fulminate pocket between the two.

199,717.—Jones & Marston, Jan. 29, 1878. The flange projects to the rear beyond the base, and may be made polygonal. The flange is bent out of shape by blow of hammer when fired, so as to engage with an extractor.

DIGEST OF CARTRIDGES

SHOWN IN

AMERICAN PATENTS FOR FIRE-ARMS.

(SEE ILLUSTRATIONS, PLATE 9.)

1,422.—B. F. Smith, Dec. 5, 1839. (Muzzle Loader.) Paper case. Wad or disk above powder contains fulminate, which is fired by a needle.

1,461.—Hall and Day, Dec. 31, 1839. (Breech Loader.) Shell in the nature of false breech, to be loaded and capped and packed in cartridge box. When loaded with shot a cut wad is put over the shot. When loaded with ball the bullet may be patched.

6,139.—D. Minesinger, Feb. 27, 1849. (Breech Loader.) Shell like the preceding, but made with a taper for easy removal from the breech, and having a parabolic powder chamber.

11,191.—E. Lindner, June 27, 1854. No description.

11,835.—G. F. & A. H. Palmie, Oct. 24, 1854. (Breech Loader.) No description.

12,567.—A. T. Watson, March 20, 1855. (Magazine Gun.) Series of rubber or paper cased cartridges connected by rubber cord passing through bullet and powder.

13,474.—J. Swyney, Aug. 21, 1855. (Magazine Gun.) Base of projectile filled with powder and secured by cover of fabric.

16,477.—H. Genhart, June 27, 1857. (Revolver.) Thin metal shell having priming tube extending well into powder.

22,348.—E. Claude, Dec. 31, 1858. (Revolver.) No description.

24,414.—Wm. Mont Storm, June 14, 1859. (Breech Loader.) Stem or stick extending back from base of bullet to stiffen cartridge. Case of paper or fabric.

24,730.—Gallager and Gladding, July 12, 1859. (Breech Loader.) Case of paper or wood, or metallic shell, or wood or paper banded with metal. Pin fire.

30,714.—J. Boynton, Nov. 27, 1860 (Breech Loader.) Stem extending back from projectile carries fulminate in hollow end.

32,887.—W. Palmer, July 23, 1861. (Breech Loader.) Case of paper. Tallow in front of bullet, in front part of case.

36,531.—B. S. Roberts, Sept. 23, 1862 (Breech Loader.) Flange on upper portion of metallic shell.

36,571.—M. Moses, Sept 30, 1862. (Breech Loader) Metallic charge chamber which forms reinforce for a pistol.

40,151.—J. H. Wiechman, Sept. 29, 1863. (Breech Loader.) Metallic shell, nicked at its front end. Rear end covered by piece of bladder Blank cartridge may be made of paper, filled with powder and hair, which is covered by paper wad.

40,572.—Morgenstern and Morwitz, Nov. 10, 1863. (Breech Loader.) Paper case, entirely covering bullet. Cap between base wads.

40,992.—J. W. Cochran, Dec. 22, 1863. (Breech Loader.) No description.

46,131.—F. D. Newbury, Jan. 31, 1865. (Revolver.) Metallic shell. Internal disk anvil having notched edges.

50,125.—C. Howard, Sept. 26, 1865. (Breech Loader.) Metallic.

57,269.—J. H. Selwyn, Aug. 14, 1866. (Breech Loader.) Metallic. Spheroido-conical base. One form has semi-circular depression in base, containing fulminate, which is covered by metallic disk. Another form has inverted perforated cap in base. Shells may have longitudinal ribs.

58,525.—D. Williamson, Oct. 2, 1866. (Breech Loader.) Metallic cartridge.

62,465.—A. J Bergen, Feb. 26, 1867. (Breech Loader.) Convex base with projecting teat.

72,803.—L. Conroy, Dec. 31, 1867. (Breech Loader.) Packing ring outside of shell. Tube extending from fulminate to forward end of powder; or shell may have smaller inside tube, fluted or not, to carry flash of the explosion of the fulminate to front end of powder.

74,594.—S. S. Rembert, Feb. 18, 1868. (Breech Loader.) Nipple or pin extending across case, to explode cap on opposite side.

74,888.—C. Callaghan, Feb. 25, 1868. (Breech Loader.) Shell of thin sheet metal, with cone screwed in at side.

81,283.—J. Merlett, Aug. 18, 1868. (Breech Loader.) No description.

86,091.—L. A. Merriam, Jan. 19. 1869. (Breech Loader.) Internal cup in base of shell. Anvil secured by pressing metal of shell upon it.

86,971.—J. B. Conklin, Feb. 16, 1869. (Breech Loader.) Anvil is a pin extending back from bullet. Fulminate in a teat extending from base of shell.

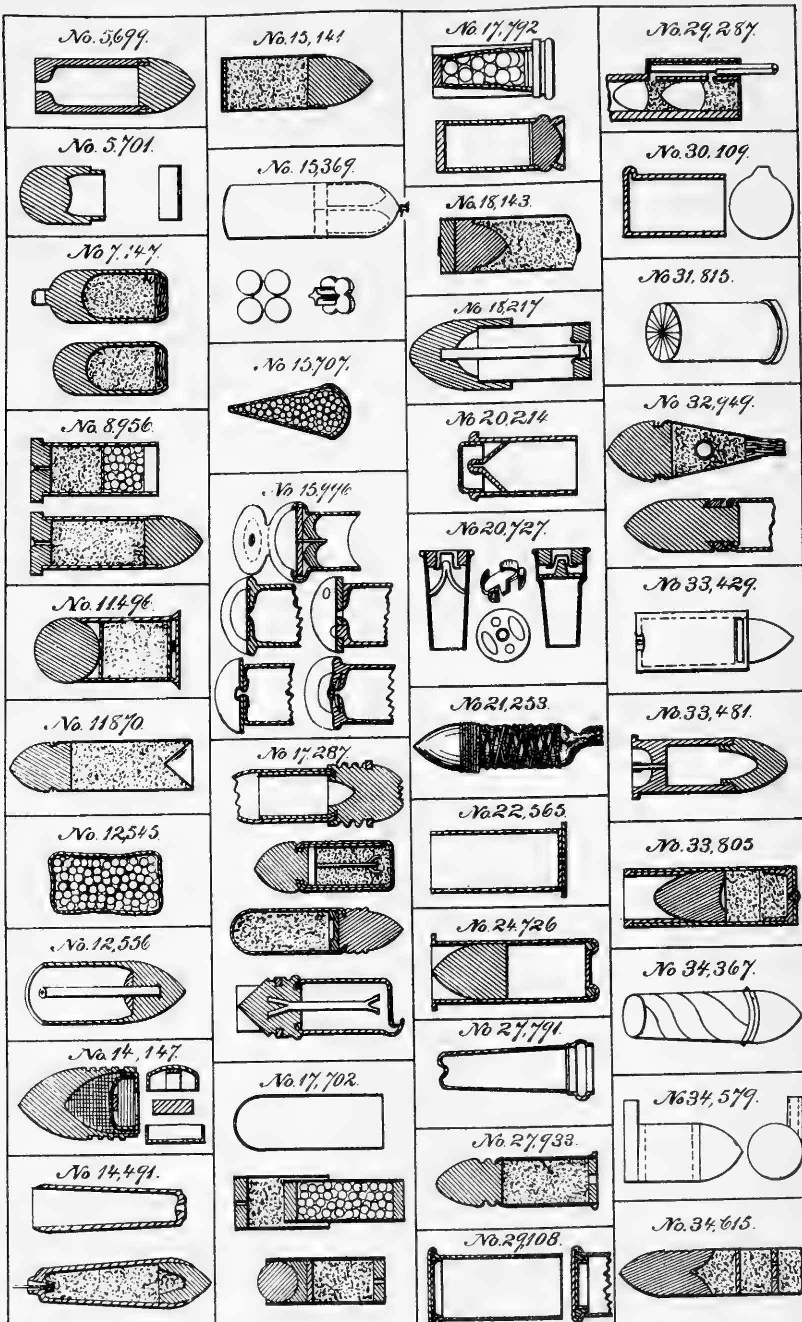
97,780.—F. A. Le Mat, Dec. 14, 1869. (Revolver.) Shell secured to neck of bullet. Slugs back of bullet are sectors of a cylinder.

105,093.—J. Kraffert, Nov. 1, 1870. (Magazine Gun.) Metallic tube screwed upon cast-iron head. Priming tube projects into powder to near base of bullet. Head has lateral groove, and a projecting pin to show position of cartridge in gun.

112,763.—W. C. Dodge, March 14, 1871. (Breech Loader.) Nipple inclosed in, and lower than, priming cup. Metallic or paper tube and metallic base cup.

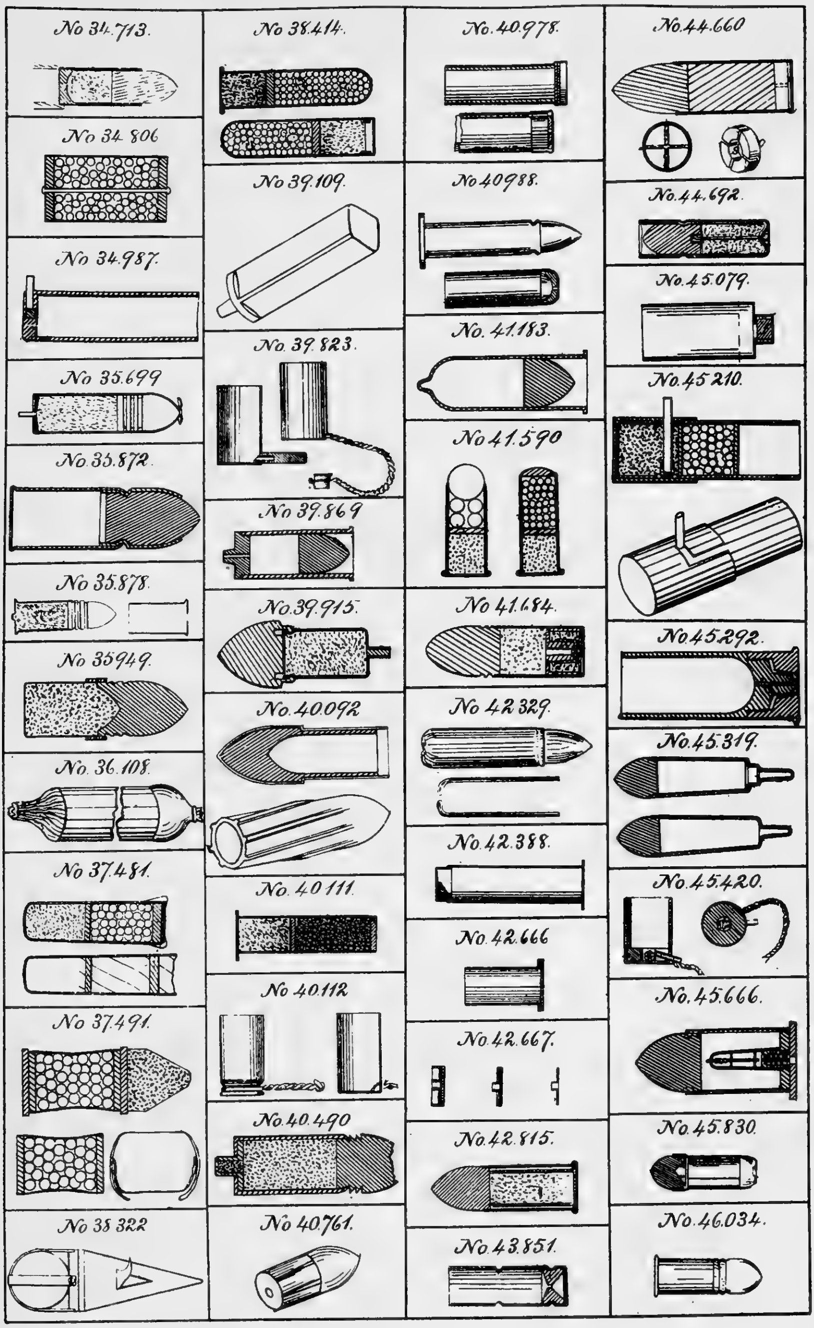
147,567.—I. M. Milbank, Feb. 17, 1864. (Breech Loader.) Powder in shell divided by wad of paper or other yielding material.

CARTRIDGES—AMERICAN. PLATE 1

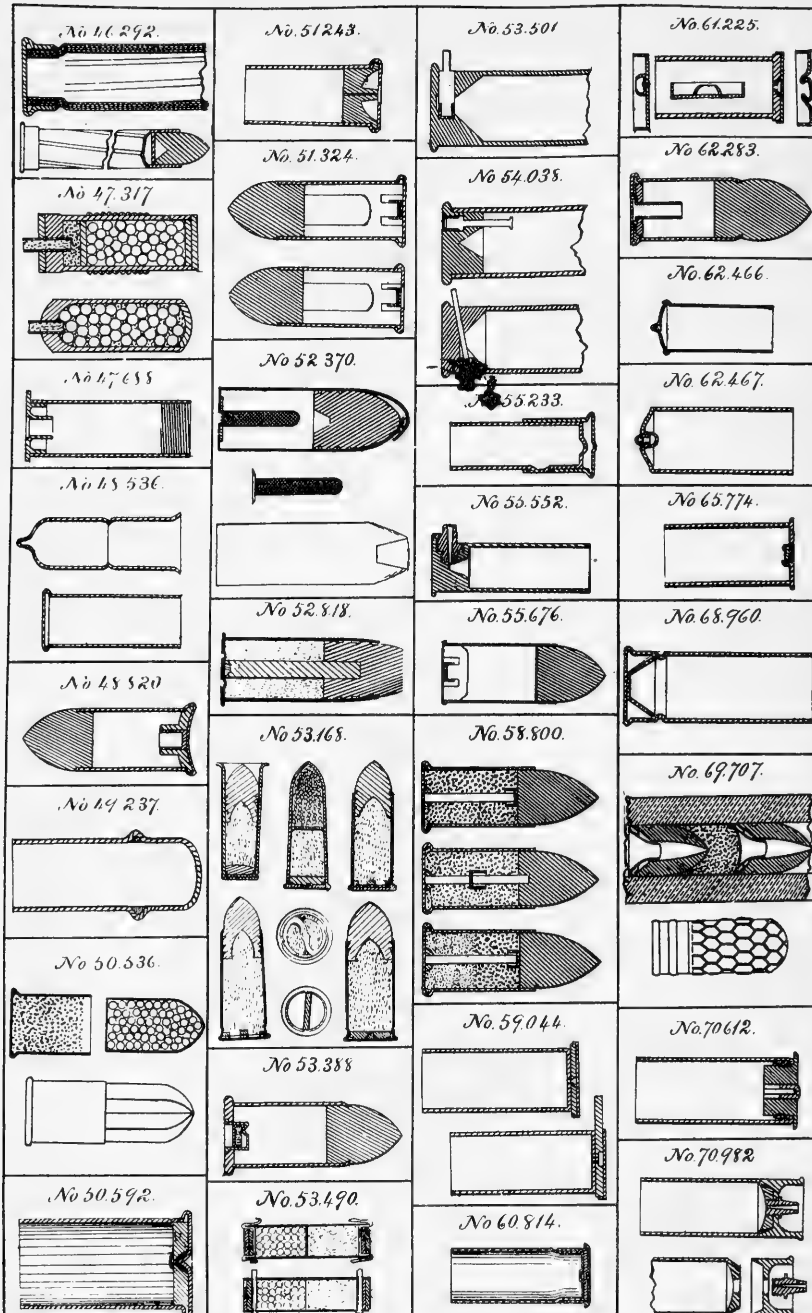


F B Brook Del

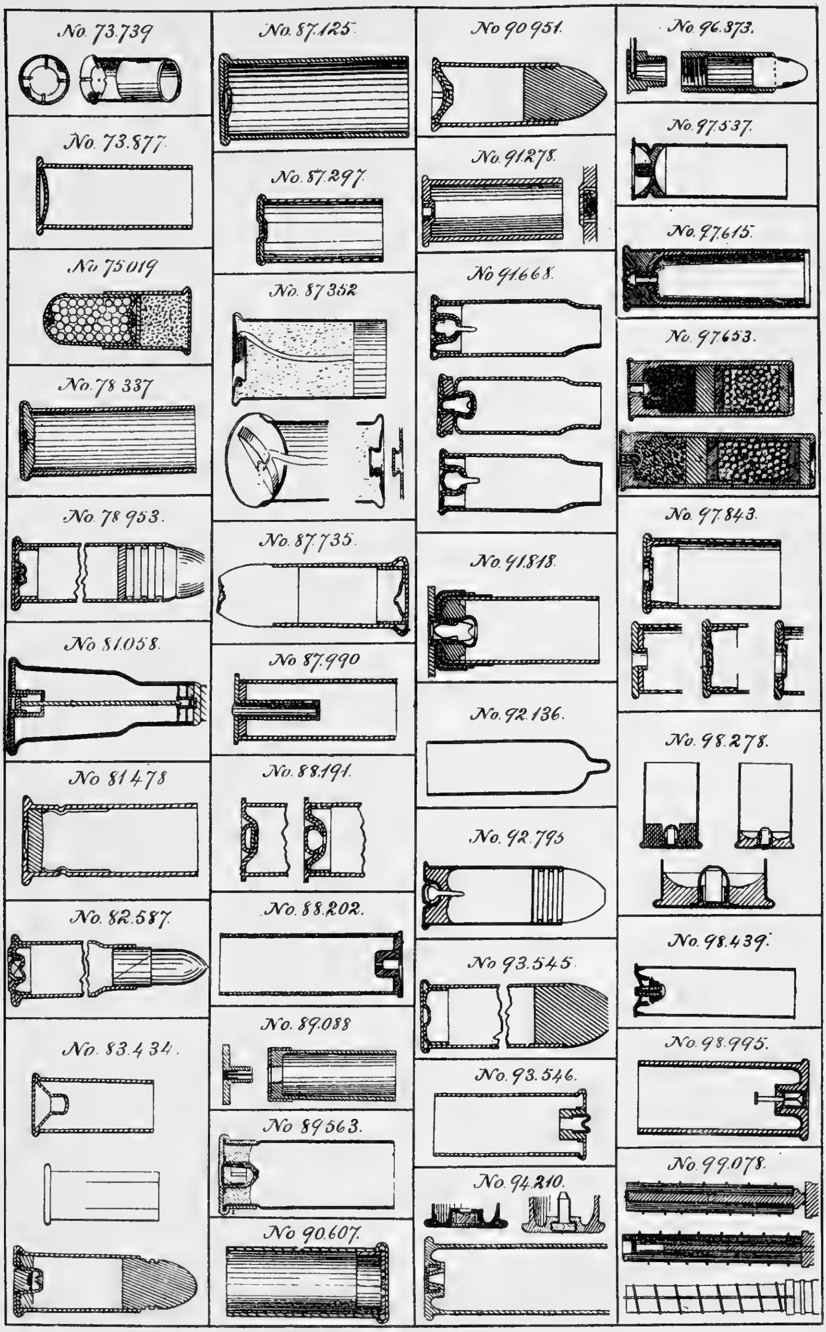
CARTRIDGES—AMERICAN. PLATE 2.



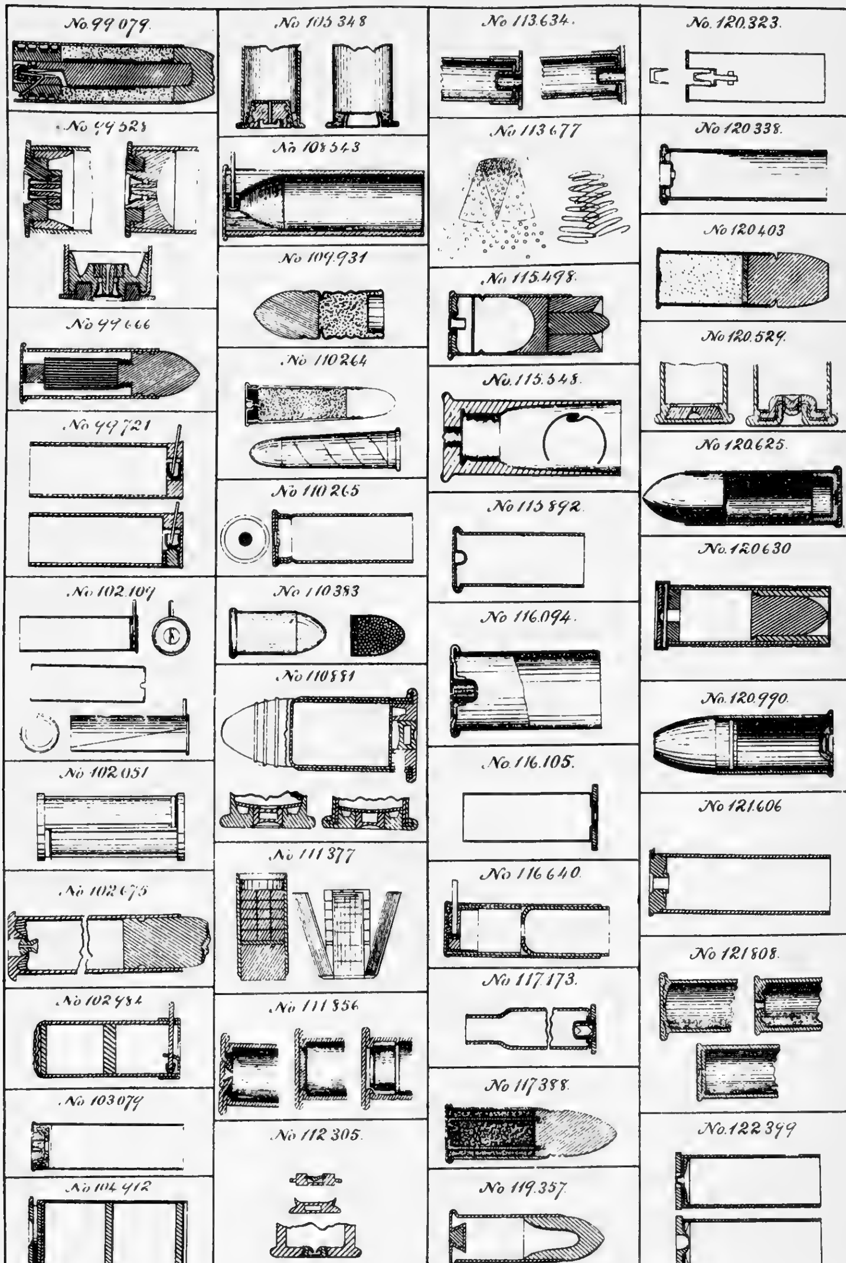
CARTRIDGES—AMERICAN. PLATE 3.



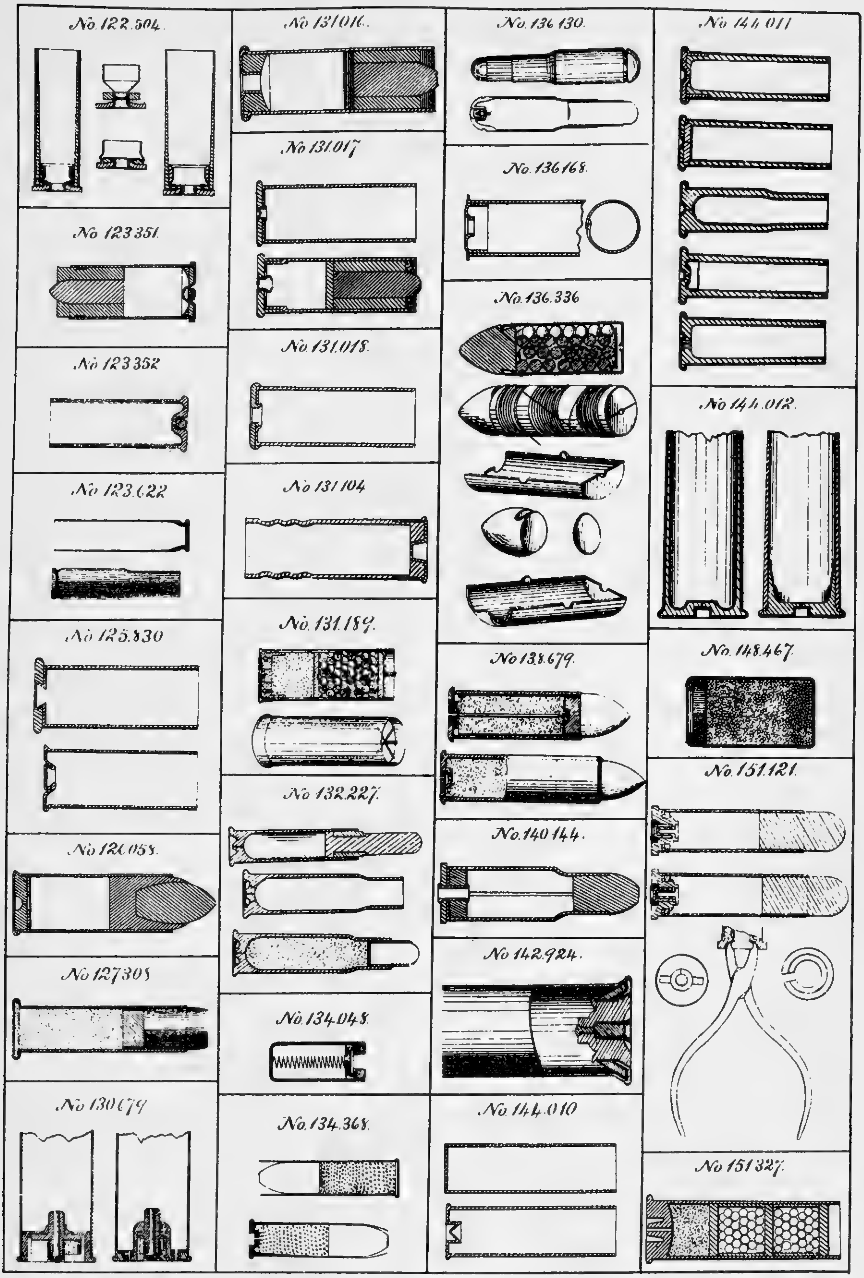
CARTRIDGES—AMERICAN. PLATE 4



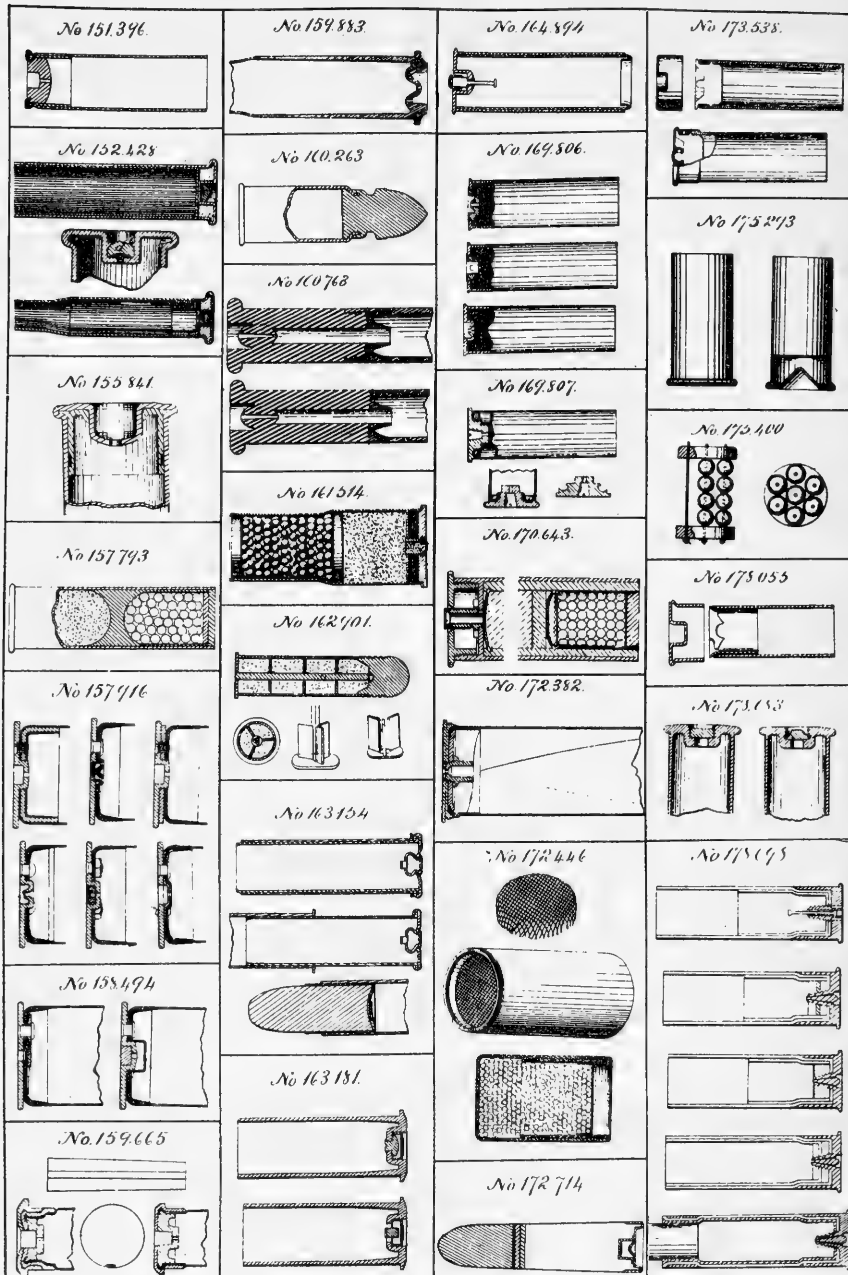
CARTRIDGES—AMERICAN. PLATE 5.



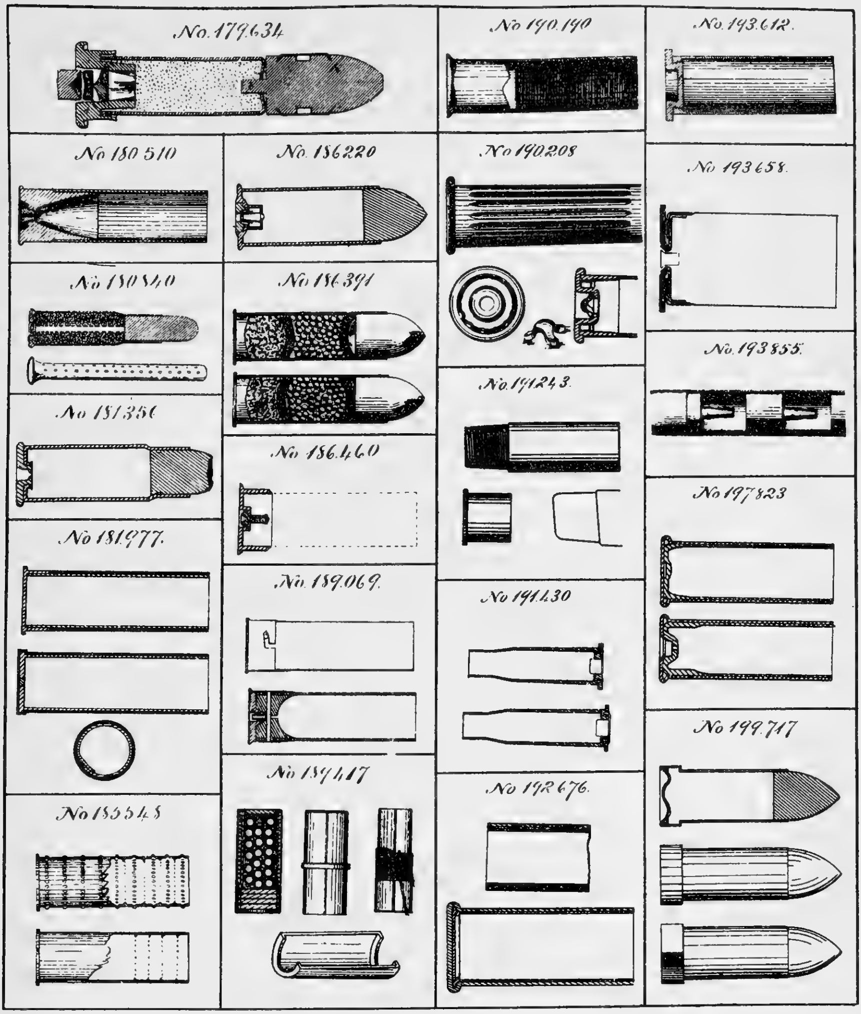
CARTRIDGES—AMERICAN. PLATE 6.



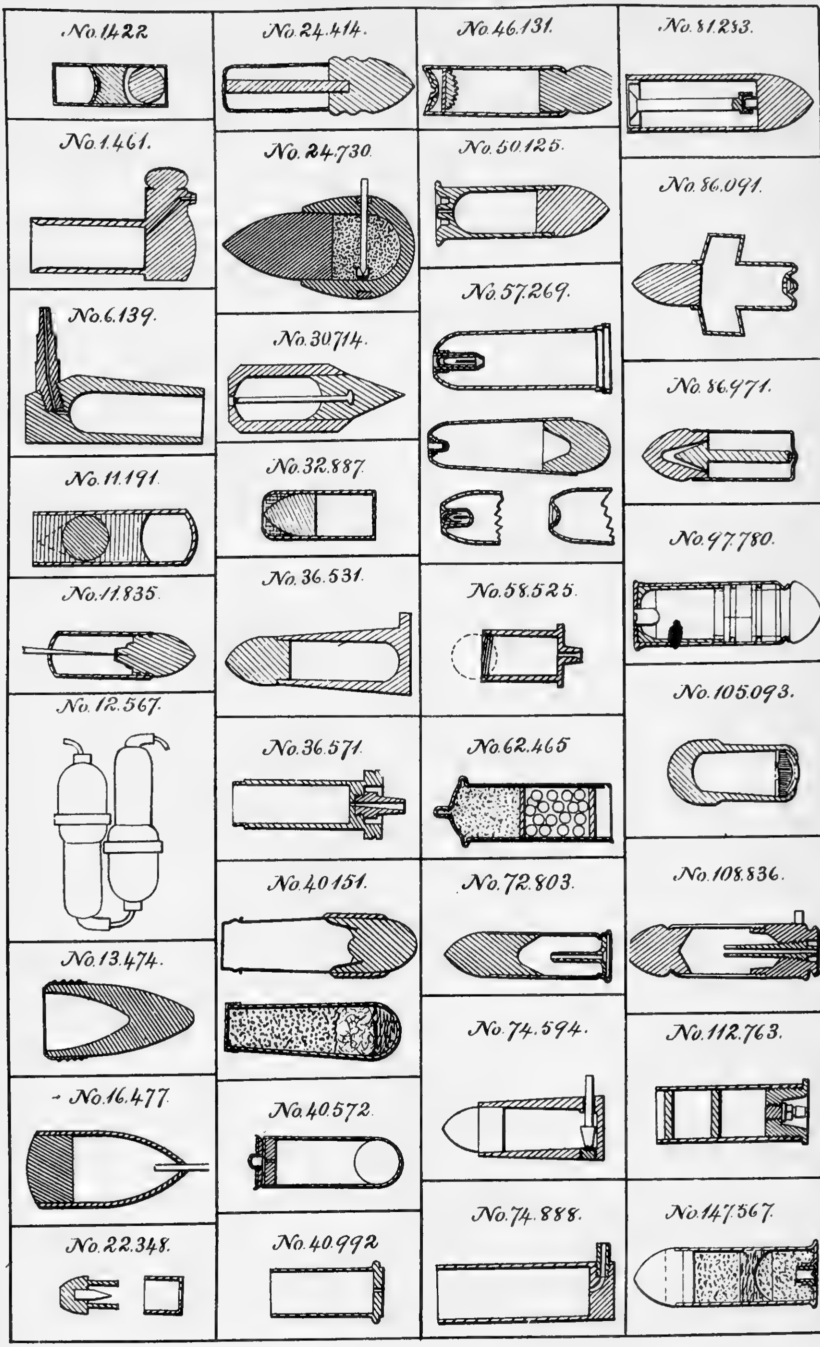
CARTRIDGES—AMERICAN. PLATE 7.



CARTRIDGES—AMERICAN. PLATE 8.



SHOWN IN PATENTS FOR FIRE-ARMS. PLATE 9



APPENDIX 2

DIGEST OF CARTRIDGES

(For Small Arms)

PATENTED IN ENGLAND

PRIOR TO JANUARY 1, 1877.

No.	Date.	Plate.	Description.
4,026	1816	15	Perforated base of metal, wood, or paper mache, on which the paper case is wound. Base is made to fit tapered breech.
5,570	1827	1	Woven wire. Wide meshes to allow shot to scatter. May be inclosed in paper case.
5,708	1828	1	In two parts, so that powder may break off from shot.
6,137	1831	..	Tube containing fulminate projects from base.
6,139	1831	1	Projectile is a cylinder of lead cut in twelve pieces. The cap is secured in recess in front of projectile until taken out for use.
6,196	1831	15	Cartridge carries cap in its base.
6,611	1834	15	Cup of wood or lead at base, bored to receive section of priming tube.
7,980	1839	1	Ball attached to cartridge by muslin envelope.
8,143	1839	1	Inner case spiral wire, outer case paper.
8,513	1840	1	Case of cardboard. Base of cardboard, wood, or metal containing metallic cap or fulminate in recess.
9,129	1841	15	Charge in base of ball, or in small paper box attached to ball. Charge may be fulminate or powder and fulminate.
10,364	1844	..	Non-inflammable paper case.
11,657	1847	15	Case of combustible paper or cloth. Tip of cartridge impregnated with fulminate, or may be capped. Charge may be gun cotton.
11,994	1847	1	Powder in projectile closed in by perforated metal plate.
12,613	1849	15	Cap secured between pasteboard wads at rear of cartridge.
12,648	1849	15	Fulminate in ring at base, with needle extending through cartridge; or fulminate in interior. Perforated tube extending beyond cartridge.
12,920	1850	15	Cap in pasteboard wad at base of bullet. Case of paper, lubricated.
13,215	1850	15	Charge of molded explosive agent in paper case.
13,377	1850	1	Tin foil covering, with needle in side to break case when rammed. Incombustible wads.
14,227	1852	1	Paper case, with fulminate in conical recess at base.
1	1852	1	Shell of copper. End of shell may be closed with paper.
184	1852	2	Base ring of soft metal, which expands on firing. Has tail for drawing out. One form of shell is of soft metal punched up with bullet.
633	1852	15	Powder in projectile.
555	1853	15	Sole leather base, paper case.
591	1853	2	Recess to fit over nipple in breech of gun.
1,000	1853	..	Made thin, to break and permit escape of powder.
1,123	1853	2	Powder and fulminate at pointed end of acorn-shaped case.
1,320	1853	..	Wooden wad in rear, to be driven out by next cartridge.
1,376	1853	..	Tin case, coated with flock.
1,390	1853	..	Paper weak in front part, to burst when rammed.
1,447	1853	..	Projectile has recess in rear to contain charge.
1,499	1853	..	Percussion tube extends from rear end of cartridge.
1,870	1853	15	No description given in patent.
2,176	1853	..	Has tube attached, filled with fulminate.
2,313	1853	2	Linen envelope for powder and ball. Paper cup at base.
2,690	1853	2	Wooden wad surrounded with fibrous packing, left in gun when fired.
2,778	1853	2	Perforated self-priming metal base.
2,829	1853	2	Weak in parts, to permit escape of powder when rammed. Gores or metal ring at tail end. Wads pressed from fluid pulp.
424	1854	2	Projectile contains charge. Disk in powder carries fulminate.
476	1854	15	Cork disk closes rear, and is left behind when fired by needle.
955	1854	2	Percussion made up with cartridge.
1,065	1854	15	Paper case.
1,147	1854	2	False breech-piece to contain charge.
1,754	1854	15	Percussion patch attached to projection on bullet.
1,954	1854	..	Same as 2,089, 1854.
2,089	1854	2	Powder in front, bullet behind serves as gas-check, and is fired by next cartridge.
2,297	1854	2	Case of paper or thin sheet copper, having perforated bottom covered with gauze. Felt cleaning wads connected by rivet.
2,351	1854	..	Wad carries fulminate. Paper case, with end closed by thin paper.
2,487	1854	3	Tang on bullet carries cleaning wad. Case of varnished paper.
2,523	1854	..	Thin veneer in end of case, which bursts when rammed.
2,530	1854	3	Pointed rear end carries cap.
2,693	1854	..	Case of fusible alloy; (zinc, lead, and bismuth.)
33	1855	..	Paper tube. Elastic wad between bullet and powder.
173	1855	..	Case of gun-cotton paper, to be consumed on firing.
193	1855	..	Case of paper, two sheets, with waterproof mixture between.
198	1855	..	Case of oiled paper, covered with flock. Ring in base tears off.
210	1855	..	Case of waterproof paper.
213	1855	3	Central needle ignites fulminate between powder and ball. Base withdrawn by firing needle.
373	1855	..	Case of paper and metal, self lubricating.
400	1855	3	Case of thin paper. Charge, gun-cotton.
513	1855	..	Cap attached by wire which tears cartridge when removed.
812	1855	15	Bullet inclosed in folds of paper Disk of paper attached to base, and a wad behind this disk is left behind when fired.
1,034	1855	..	Cloth made of floss-silk, hot calendered, for cartridge cases.
1,121	1855	3	Charge in recess of bullet, covered with disk of gutta percha.
1,125	1855	3	Case of metal or paper. Lubricating belt of oiled tow or leather.
1,183	1855	15	Paper case. Bullet of iron partly covered with lead.
1,191	1855	3	Metallic case, closed by paper base.
1,324	1855	3	Case of metal foil, cemented to bullet. May have outer case and tape to draw out shell. Self lubricating.
1,436	1855	3	Paper case.
1,887	1855	..	Self lubricating. Case of metal, or paper and metal.
2,204	1855	3	Projecting tube contains fulminate.
2,581	1855	3	Same as Burnside cartridge.
2,729	1855	3	Mouth covered with thin paper. Disk of calico packed in hollow wooden wad attached to rear.
2,742	1855	..	Sheet gutta percha or muslin case.
2,952	1855	..	Paper case. Felt cylinder attached to bullet.
337	1856	3	Metallic shell, burred down over base of bullet. Shank on bullet may serve as anvil. Mouth covered with paper.
780	1856	3	Tissue paper or gun-cotton in base of cartridge to cover perforated wad.
1,806	1856	..	Case of metal tubing, which may be weakened by acids.

No.	Date.	Plate.	Description.
1,849	1856	3	Bullet contains charge and priming.
2,059	1856	..	Seamless membrane for case, may be covered with net or thread.
2,868	1856	3	Percussion tube of copper or glass attached to cartridge.
351	1857	4	Paper case. Fulminate in tube attached to base of bullet.
622	1857	4	Paper case attached to bullet by casting or pressure.
907	1857	15	No description given.
1,098	1857	4	Fulminate made up with cartridge for needle gun.
1,357	1857	18	Metallic shell, which may be split to permit expansion. Lead disk in base.
2,630	1857	4	Flexible. Two parts held together by paper case.
138	1858	4	Wads gummed into paper case. Outer wad has tape attached.
465	1858	..	Shell of lead and tin, drawn or pressed.
484	1858	4	Shell has base of lead.
533	1858	4	Ring attached to cartridge by strap. Ring stops at muzzle in loading, and is removed by ramrod. Sheet metal wads covered with flock.
535	1858	..	Thimble shaped cups for powder and ball, gummed together, and may be made up with wads in outer case.
844	1858	4	Made of sheet gutta percha.
1,164	1858	4	Expansible head in metallic case. (Morse, American.)
1,172	1858	4	Metallic—bottle-necked.
1,306	1858	..	Metallic ring to secure percussion cap at center of base.
1,321	1858	4	Case of paper, gutta percha, or metal, open at both ends, (for muzzle loader, muzzle of gun shown in drawing.)
1,497	1858	4	Recess in base of case filled with lubricant.
1,911	1858	..	Metallic cartridge.
2,095	1858	4	Metal or gutta percha struck up by dies.
2,149	1858	4	Wad or metallic thimble at base.
2,213	1858	4	To load same 1,321, of 1858. Cork retains powder, and is removed before charging.
2,246	1858	4	Case of two fabrics, one weaker than the other, to burst under pressure of ramrod.
2,444	1858	..	Case of sheet rubber. Cap fits in hole in cartridge, which is burst before charging.
2,619	1858	4	Cartridges have metallic capsule.
2,668	1858	..	Case of paper made waterproof by soap and alum in pulp.
114	1859	4	Lubricated wad behind projectile attached to case by wires to draw it out.
207	1859	4	Metallic.
236	1859	4	Metallic base-cap containing felt wad.
372	1859	4	Elastic case, such as rubber.
566	1859	15	Tube extending into powder to ignite it at center.
731	1856	15	Fulminate inside of case.
874	1859	..	In compartments separated by disks. Accelerating.
1,132	1859	..	Wire cloth or perforated metal shell dipped in gutta-percha.
1,175	1859	..	Tapered, with cap at end, so that capping gun releases powder.
1,255	1859	..	Case waterproof and inflammable, varnished outside or inside.
1,346	1859	..	Chalk, soapstone, plumbago, &c., as lubricant.
1,622	1859	15	Paper case nipped in bullet. Metal shell for shot cartridge.
1,959	1859	4	Charge pushed through into muzzle by ramrod.
2,033	1859	4	Lubricating wad at rear of bullet.
2,120	1859	..	Shot cartridge; has concave wad, perforated or not.
2,188	1859	5	Metallic shell with nipple.
2,263	1859	5	Cap at rear placed on anvil.
2,375	1859	..	Paper made combustible by mineral salt.
2,400	1859	5	Cardboard case.
2,657	1859	5	Paper case, closed by gum. Ring on outside of powder end bursts paper when applied to gun.
2,791	1859	..	Case of collodion formed on a mandrel.
285	1860	5	Separate powder and shot cartridges. Breech plug to adapt gun for use as muzzle loader.
389	1860	5	Case made of wound paper, or molded from pulp.
491	1860	..	Cartridge lubricated with paraffine.
566	1860	5	Case of wood, with "cap" of paper, leather, or thin metal.
634	1860	..	Percussion tube extending from side.
661	1860	5	Paper and metal, rolled up and cemented.
694	1860	..	Paper case having cross wires.
899	1860	5	Pin fire. Has wad in base, which is expanded into recess in breech-bolt on firing.
954	1860	5	Back end coated with composition of phosphorus, antimony, and emery.
1,018	1860	5	Rear part metal, containing priming and powder. Front part paper, containing shot.
1,056	1860	5	Fulminate tube inside of metallic shell.
1,168	1860	5	Thin metal disk attached to wad.
1,295	1860	..	Case waterproofed by collodion.
1,570	1860	5	Wad of soft woven fabric.
1,574	1860	5	Powder in front of ball. Paper case.
1,605	1860	..	Silk case.
2,533	1860	5	Metal plug screwed into base. Shot surrounded by fabric.
2,954	1860	5	Paper case; plug of metal, earthenware, wood, vulcanite, &c.
3,140	1860	..	Tempered metal shell, smaller than bore, to expand when fired.
256	1861	5	Case of cardboard or sheet metal, with metal base.
916	1861	5	Case of metal and paper.
930	1861	..	Case of aluminium, slit longitudinally.
992	1861	..	Gutta-percha lined with paper.
1,396	1861	..	Rim on case holds it at muzzle while charge is pushed through by ramrod.
1,758	1861	5	Firing-pin in solid base of cartridge.
2,128	1861	..	Paper case stopped with cork.
2,203	1861	5	Cap in pressed paper wad.
2,453	1861	15	Case of pasteboard, lubricant held in by wad.
2,601	1861	..	Paper for case treated with acid and covered with collodion.
2,731	1861	..	Flange projects from rear. Tail on flange carries cap.
2,832	1861	..	Charge of powder separated by perforated disks. Accelerating.
55	1862	..	Paper or cloth coated with paraffine for case.
107	1862	15	Metallic case, with cap or wafer inside.
432	1862	..	Metallic case covered with collodion.
507	1862	..	Case partially cut, so as to tear readily in charging.
679	1862	..	Powder pressed into cakes, and covered with collodion.
743	1862	5	Metallic shell, rim fire.
789	1862	5	Flange projects from rear. Tail on flange carries cap.
1,544	1862	..	For needle gun. Thick case contains powder, thin case for shot. Mouth fastened by metallic ring.
1,635	1862	..	Movable percussion tube inserted in cartridge when about to be used.
1,761	1862	..	Charge of pressed powder, with cavity therein, connected to bullet by peg.
1,763	1862	..	Metallic.
1,828	1862	15	Piston and cap in interior, or small perforation in base of case.
1,985	1862	5	Metallic. Rear end struck up or reduced in thickness to be fired by cap.
2 349	1862	6	Copper shell with central aperture.
2,351	1862	6	Metallic, rim fire.
3,173	1862	..	Woven fabric for case covered with paper, leather, silk, &c.
3,466	1862	..	Powder divided by perforated disks. Accelerating.
406	1863	..	Steel case. Front part of paper or silk attached by cement.
446	1863	15	Shell of spun brass, rear aperture closed by wax.
1,274	1863	..	Self-primed cartridge.
1,738	1863	6	Pin has enlargement which serves as gas-check. Paper case with drawn metal base-cup.
1,881	1863	6	Shell of thin wrapped sheet-metal, or paper and metal.
1,971	1863	..	Compressed powder in metallic shell.
2,072	1863	6	Paper case nipped in groove in bullet.
2,120	1863	..	Fulminate in metallic flange with annular cap.
2,346	1863	..	Case nipped in groove in bullet.
2,597	1863	6	Metallic base has internal recess for cap.
2,840	1863	..	Membrane chemically treated for case.
2,870	1863	6	Paper case nipped in bullet.
3,159	1863	..	Percussion patch fixed in disk fastened in base of case.
337	1864	..	Compressed powder in flexible sheet-metal case.
469	1864	6	Metallic.
752	1864	15	Metal cup in back end of cartridge.
1,389	1864	..	Paper case, with perforated metallic base.
1,760	1864	..	Cap in bullet in which end of case is inserted, or bullet may contain charge.
1,774	1864	6	Metallic. Fulminate in projecting tube, perforated at several points in the powder.
1,953	1864	..	Flanged rim to carry cap.
2,059	1864	..	Copper shell. May be ignited by cap on neck.
2,349	1864	6	Cap fixed inside case.
2,602	1864	6	Case of wire, wrapped or lined with paper, and attached to front wad.
2,623	1864	6	Metallic. Wood and paper wad in base.
2,759	1864	..	Case of fabric, covered with collodion. Powder damped with nitro-glycerine.
2,777	1864	6	Plug of compressed powder cantains cap, or perforated disks of leather hold it.
2,892	1864	6	Case of cartridge paper, with metal bottom. Cast-steel shell for revolvers.
2,907	1864	6	Rubber ring on base serves as gas-check.
2,951	1864	6	Anvil in case at right angles. Guide-pin projects at side.
3,001	1864	..	Metallic, or with paper base.
3,026	1864	6	Metallic shells rifled to fit rifling in gun.
3,196	1864	6	Base of felt, with aperture closed by thin disks of paper.
188	1865	6	Combustible case with priming inside.
253	1865	6	Cap imbedded in powder. Case of lapped paper, unpasted.
309	1865	6	Fulminate may be around ball.
358	1865	15	Fulminate inside combustible case.
421	1865	6	Fulminate in base of bullet incased in metal; fired by needle.

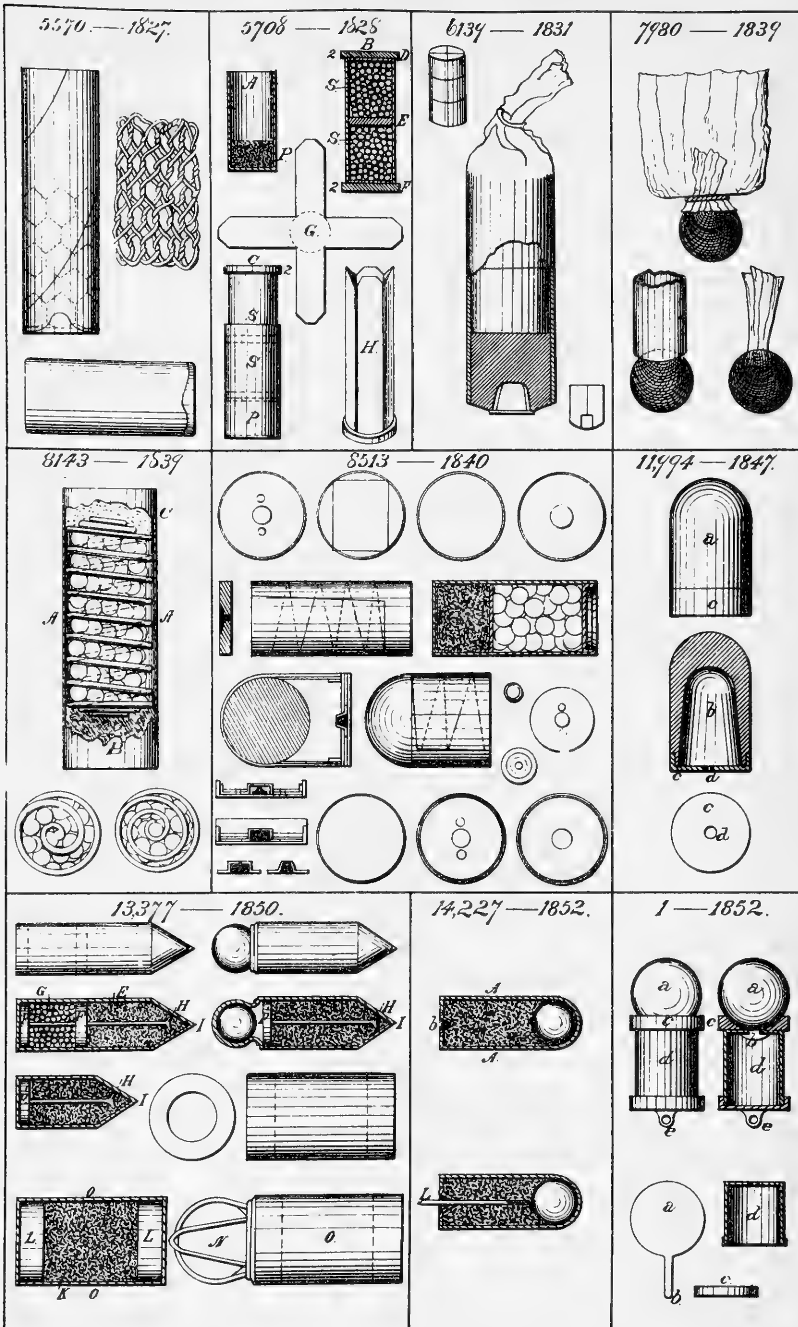
No.	Date.	Plate.	Description.
426	1865	..	Cap in case at right angles, base of cap resting on side of shell, fired by pin from opposite side.
518	1865	6	Central fire, having pin extending from side to show that the piece is loaded.
708	1865	6	Cap held in perforated disk of pasteboard, which is blown out on firing by powder behind it.
800	1865	6	Projectile has anvil.
932	1865	6	Cap at anvil on rear of bullet.
1,046	1865	..	Metallic base; paper in front contains shot.
1,289	1865	..	Disk of glass, wood, or compressed paper inside the tube serves as anvil.
1,300	1865	7	Gun-cotton roving wound on tube of cardboard; another portion of same inside the tube.
1,308	1865	7	Metallic base has recess or projection to engage extractor.
1,355	1865	7	Detachable base contains cap and striker.
1,356	1865	7	Fulminate in hollow in base, held by pasted diaphragm.
1,436	1865	..	Metallic base brazed to tubular part.
1,546	1865	..	Tapered shell.
1,750	1865	..	Paper case with pasteboard cup for fulminate.
1,888	1865	7	Metallic, with nipple for cap.
1,889	1865	7	Metallic base with nipple.
1,894	1865	7	Metallic or paper shell, with beveled end.
2,030	1865	..	Shell has external pin to indicate when piece is loaded.
2,345	1865	7	Projectile carries bursting charge in tube projecting from its rear.
2,438	1865	7	Has two or more projections, the rear one of hard alloy.
2,475	1865	..	Case of fabric which has been "gun-cottonized."
2,512	1865	7	Cap on nipple in recess in rear portion of cartridge.
2,542	1865	7	Paper case, metallic base with cup for cap and anvil. Case coated with collodion.
2,628	1865	7	Sheet metal, with or without projection around bullet.
2,709	1865	7	Iron bullet, tinned, carries powder in cavity which is closed by metallic cap.
2,906	1865	7	Wads in case coated with chemicals which explode when forced into contact.
2,981	1865	7	Cap in base of projectile.
3,178	1865	..	Cap contains anvil, tubular in form, or bent like letter N.
3,181	1865	..	Filled in between cap and case with wax, rubber, or varnish.
3,249	1865	..	Base wad has fulminate, and carries case out of gun when fired.
3,258	1865	7	Fulminate in central annular rim. Lining tube of metal, paper, or elastic substance.
3,284	1865	7	False breech.
3,304	1865	7	Cap in cardboard or metal disk. Bullet soldered to shell.
3,337	1865	7	Metallic. Annular trough for percussion in base.
3,348	1865	8	Metallic, coated with tin or alloy to prevent oxidation.
137	1866	8	Coiled sheet metal, or metal and waxed paper, or metal waxed and coated with graphite.
443	1866	..	Flattened metallic shell; anvil crimped in.
519	1866	..	Powder and shot in thin paper case, gummed into shell.
529	1866	8	Cap some distance inside of shell, to avoid explosion except by firing-pin.
562	1866	8	Metallic, with reinforce and lead thimble.
688	1866	8	Metallic lining, paper tube.
722	1866	8	Wooden sabot, having rubber ring. Gun-cotton behind sabot to blow it out when fired.
845	1866	..	Gun-cotton cloth in tube, or made up in wads.
864	1866	..	Paper case in metallic base cup; anvil tubular or N-shaped.
880	1866	8	Anvil formed in two or more parts.
1,417	1866	8	Case of thin metal or paper, covered with copper by electro-deposition, or may be copper deposited on a former. May have longitudinal corrugations.
1,932	1866	8	Bottom of case made of rubber for gas check.
1,959	1866	..	Skin or other combustible material for case.
1,976	1866	..	Projectile has pin extending backward, which carries fulminate.
2,016	1866	8	Metallic tube, held in base ring by base plug.
2,126	1866	..	Tubular case and cup-shaped base struck up by dies.
2,143	1866	8	Wad remains behind on firing, and is expelled by next fire.
2,196	1866	..	Shot charge inclosed in paper, gun-cottonized.
2,205	1866	8	Paper or composition ring around projectile. Interior gas-check. Two recesses in base to receive extractor.
2,267	1866	8	No description.
2,293	1866	8	Inner perforated reinforce, with fulminate between it and shell. May have coiled paper tube inside shell.
2,304	1866	8	Paper case, metallic disk anvil.
2,326	1866	8	Split metal tube attached to bullet, covered with paper, or paper case, or metallic shell with base cup.
2,580	1865	8	Metallic base, linen case.
2,589	1866	8	Paper wad in base of copper shell holds bent wire which serves as anvil.
2,653	1866	8	Case of linen, varnished, with metal disk base, carrying coiled tube reinforce.
2,695	1866	8	Charge of compressed powder. (For needle-gun.)
2,711	1866	8	Base recessed for extractor.
2,739	1866	..	Shell struck up by dies. Anvil of powder and starch, compressed.
2,743	1866	8	Paper or fabric case, cap between wads of felt and pasteboard at base.
2,813	1866	..	Rear end concave. Longitudinal strips of metal in case secure it to metallic base.
2,855	1866	8	Pointed wire inside, to explode cap at base of bullet.
2,946	1866	8	Pasteboard case, with base wad, inclosed in metal base cup.
3,183	1866	..	Base cast tapering, having annular grooves into which tube is crimped.
3,243	1866	8	Paper case, having lubricated base wads carrying cap and anvil.
3,253	1866	8	Separate anvil. Annular wad for cleaning gun.
3,317	1866	..	Powder around axial stem which serves as anvil.
3,356	1866	9	Paper or pasteboard flange at base of case.
3,425	1866	..	Modification of No. 114, 1859.
24	1867	..	Metallic, with base cup held in by corrugation. Space between cup and tube filled in with plaster.
52	1867	..	Cartridge incased in india rubber.
89	1867	..	Shell of two strips of metal, or one cruciform sheet, struck up.
189	1867	..	Shell rifled to fit bore, made of metal and paper or cloth or of foil and paper, with separate waterproof powder case.
240	1867	..	Brass shell lined with paper.
251	1867	9	Projectile extended to form cartridge case.
399	1867	..	Plunger moves in tube in powder to explode fulminate. Spring at rear end of shell to throw it out after firing.
445	1867	9	Paper case, with rubber washer at base.
447	1867	..	Fulminate in annular space between central pin and case.
483	1867	9	Case of pressed cloth steeped in alum; end closed by wad, perforations covered by oiled tissue paper.
519	1867	..	Parallel tubes of paper and metal, having solid metal base and anvil.
660	1867	9	Soldered tube fastened to head.
717	1867	9	Pasteboard case, with priming between pasteboard wads.
805	1867	..	Anvil in form of star, the points extending into case.
820	1867	9	Case of paper or metal with metallic head.
866	1867	9	Packing ring outside shell to prevent windage. Fulminate tube inside.
961	1867	..	Case of vegetable parchment.
963	1867	..	Solid metal base plug, having groove into which case is crimped and packed with pulp.
972	1867	9	Firing pin inside protecting tube and wad.
989	1867	..	Two or more qualities of gun cotton for charge.
1,002	1867	..	Base of rubber, or metal with rubber wrapper.
1,025	1867	..	Expelled with projectile.
1,117	1867	9	Fulminate surrounded by plug of wood or paper to prevent corrosion of brass shell.
1,143	1867	9	Shell of thin sheets of brass and paper, or paper with a porcelain anvil and copper cap. May be in the form of a screw.
1,173	1867	..	Rubber case, vulcanized or not.
1,216	1867	..	Shot cartridge coated with collodion.
1,231	1867	9	Conical base chamber formed by paper wad.
1,484	1867	9	Metallic tube screwed to metal base to form shell.
1,514	1867	9	Chamber for fulminate in center of head.
1,521	1867	..	Metallic, covered with rubber or leather.
1,590	1867	9	Linen case, with cap in pasteboard wad, or metallic tube with rubber base.
1,658	1867	9	Metallic shell, with sheet-metal bridge anvil.
1,664	1867	..	Base cup and anvil cast in one piece; secured to tube by expanding tube into grooves in cup.
1,757	1867	9	Metallic tube, or foil and paper case, or two split tubes, one over the other, breaking joints. Fulminate between disks. Wads covered with thin metal.
1,806	1867	..	Parts of shell tinned to prevent corrosion.
1,835	1867	..	Shell in one piece, of copper or alloy.
1,873	1867	..	Asbestus packed between wads
2,167	1867	9	Shell of brass, covered or lined with paper.
2,168	1867	9	Case of paper; inside cone, screwed in.
2,277	1867	9	Friction primers of various forms, ignited by needle.
2,318	1867	..	Paper case made waterproof by wax, stearine, &c.
2,469	1867	10	Base strengthened by additional wrap of metal. Gas-check or valve in base.
2,431	1867	9	Base has internal projection opposite center of cup anvil.
2,560	1867	..	Case of paper or cloth, entirely combustible.
2,654	1867	..	Fulminate between layers of pasteboard.
2,923	1867	10	Thread of gun-cotton passes through powder.
3,127	1867	..	Gun-cotton, compressed and rendered waterproof.
3,187	1867	10	Cup anvil secured by indentation in shell.

No.	Date.	Plate.	Description.
3,211	1867	10	Base held to tube by plug of paper, or by solder.
3,308	1867	..	False breech of steel used as cartridge.
3,324	1867	10	Metal plug, in sections, screwed together, in base of metallic shell.
3,345	1867	10	Fulminate in base of bullet.
3,517	1867	..	Shells of tin, reduced to any thickness by electro-plastic process.
3,562	1867	..	Same as 1,757, 1867.
12	1868	10	Anvil is a concave plate, made thin at the edges.
70	1868	10	Shell of wound brass foil. Cartridge fired by friction primer.
285	1868	..	Socket of anvil bent to M-shape.
317	1868	10	Solder inside rim. Reinforce cup inside shell.
519	1868	10	Metallic. Cap held in place by wad of pressed cardboard or pressed gun-powder.
755	1868	10	Foil combined with paper. Wads covered with foil.
930	1868	..	Case made of paper in layers, with fulminate in hole in base, covered by layer of rubber
952	1868	..	Metal, or metal and paper. Shells corrugated or fluted longitudinally, oblique, or helically.
968	1868	10	Thin metal shell, with rim around bullet, and pasteboard wad in base.
980	1868	..	Tube contains fulminate.
1,107	1868	10	Solid flange on shell. Wad rests against inside shoulder.
1,180	1868	..	Metallic, varnished inside. Lining of glue and sawdust around plug at base. Disk of lead over fulminate.
1,200	1868	10	Brass shell. Bullet has paper patch.
1,252	1868	..	Nipple on interior of base-plug, fixed by screw within a tube reaching to center of powder.
1,686	1868	10	Perforated metal base, external cap.
1,736	1868	10	Cylinder projecting into powder contains a needle and gas-check.
1,791	1868	..	Metal base chamber, with shoulder, to receive anvil and fulminate.
1,834	1868	10	Metallic, with open base turned into double cap.
1,870	1868	..	Base has internal cup for fulminate.
2,009	1868	10	Metallic shell reinforced, with metal disk between reinforce and shell.
2,018	1868	10	Fulminate in base of projectile.
2,033	1868	..	Steel tube having central perforation surrounded by groove forming nipple.
2,038	1868	10	Metallic base secured to shank by straps. Tube of coiled metal; rubber washer passed over part of case
2,049	1868	10	Paper tube. Base wad of felt held between star shaped pieces of fabric, pasted to tube.
2,062	1868	..	Struck up from tin, alloys, or lead.
2,077	1868	..	Bullet flexibly connected to shell.
2,096	1868	10	Paper case, with vulcanized rubber packing round cap.
2,534	1868	11	Sheet metal tube with base-cup soldered thereto.
2,628	1868	..	Internal cup struck up in base, with edges turned over to form or secure anvil.
2,712	1868	10	Case double. Compressed paper in base.
2,900	1868	..	Rim fire.
3,068	1868	11	Cap serves as rivet to hold solid disk base to tube, or a projection on base forms rivet.
3,131	1868	11	Fabric or metal case.
3,173	1868	11	Metallic.
3,182	1868	..	Closed end of tube raised into neck, carrying felt wad.
3,286	1868	11	Paper case.
3,433	1868	..	Case of paper or metal with wad and metallic thimble in base.
3,512	1868	..	Metallic disk at base carries cap covered with thin sheet of brass or copper.
3,709	1868	..	Cylindrical powder chamber closed on conical anvil. Annular ribs on inside of cup or head.
3,981	1868	11	Cap secured in shell by pressing down metal over cap after it is inserted.
3,987	1868	11	Flange extends backward parallel with sides of shell.
88	1869	11	Lubricating wads between bullet and powder. Boxer shell.
118	1869	11	Thin copper, wrapped in paper to prevent uncoiling. Pasteboard wad contains anvil and cap. Bullet held by short paper tubes.
166	1869	11	Coiled shell, fluted at front to reduce diameter.
462	1869	11	Hollow cylindrical wads partly surround shot to prevent scattering.
591	1869	11	Metallic cup in front of paper base. Annular coil of metal inside case has one end in this cup.
622	1869	11	Double metallic concave washer at base serves as flange for extracting shell.
624	1869	..	In one piece, with internal thimble or ring.
825	1869	..	Friction primer in base, operated by pulling a string or turning a disk.
893	1869	11	Wire attached to wad in rear of bullet, terminating in twist in paper case at rear end.
938	1869	11	Base wad strengthened by metal thimble. Wad carries tube extending into powder.
1,020	1869	11	Wire extending back into cap serves as anvil.
1,062	1869	..	Coil of thin metal forms shell, one end of coil serving as clip to hold all together. Varnished inside, or lined with waxed paper.
1,184	1869	11	Accelerating powder charges.
1,257	1865	..	Tube with cupped hollow rim for extractor to engage internally. May have outer reinforce tube open at both ends.
1,379	1869	..	Inner and outer case, one of cloth the other metal, attached together by varnish.
1,490	1869	11	Base strengthened by solder melted in.
1,530	1869	11	Base strengthened by solder. Front of shell bored out to receive bullet. Varnished tin foil over primer, perforated.
1,547	1869	..	Perforated disk of sheet brass or copper over cap, holds coiled tube of metal, or metal and paper.
2,071	1869	11	Case of paper, with metal thimble at base, and rubber wad between. Wire from front wad carries out paper case when fired.
2,076	1869	11	Metallic base cup. Tube made from diagonally cut sheet, and has inside and outside reinforce.
2,107	1869	..	Front end of case slit, so as to compress on bullet.
2,257	1869	11	Drawn with solid head. May have internal reinforce.
2,399	1869	11	Cap pocket impressed in base.
2,427	1869	11	Joint around hat-cap secured by metallic rim. Shells electroplated inside or out.
2,659	1869	11	External primer sunk in base of solid shell.
2,692	1869	..	Cleaning-wad larger than bore of gun. Zinc shell, with iron base and rubber wad.
2,747	1869	12	Fulminate in roll of explosive paper.
2,862	1869	..	Open end of shot cartridge turned in over wad.
2,944	1869	..	Shaped like truncated cone, with lateral channel into smaller base.
3,175	1869	12	Turned-in end of shell forms anvil.
3,303	1869	12	Anvil riveted in base cavity. Base strengthened by solder.
3,481	1869	..	Anvil and cap made in solid piece.
3,533	1869	..	Internal tube through powder, with cap at base.
3,577	1869	..	Tin shell, riveted to iron base. Bonnet has lining of brass, to protect tin.
3,641	1869	..	Anvil and cap solid.
3,763	1869	..	Anvil and cap solid.
45	1870	12	Steel tube, lapped or soldered. Copper base.
116	1870	12	Shell has parts cut away in front, to enable it to be reduced in size.
144	1870	12	Cap and anvil in one piece, or anvil enlarged.
353	1870	12	Cap between two disks at base. Tube burred over these disks.
453	1870	..	Recess around cap in base of metallic shell.
1,283	1870	12	Base of felt or pulp riveted to metallic shell.
1,448	1870	..	Flame ducts of compressed powder, or pasteboard, surrounded by charge.
1,635	1870	..	Metallic. Large wad at rear of bullet.
1,652	1870	..	Bullet surrounded by rifled ferrule. Socket or hinge of elastic or plastic material.
1,658	1870	12	Opening at one side for cap. Opening opposite for pin to eject cap.
1,745	1870	12	Front part rifled—rear part cylindrical.
1,829	1870	..	Shot cartridge, with front part of case partially severed, so as to go with shot when fired.
2,286	1870	12	Metallic. Nipple at rear.
2,611	1870	12	Case wholly of paper—metallic anvil.
2,675	1870	12	Shoulder forward of base of shell. Reinforce soldered to shell.
2,769	1870	12	No description.
2,893	1870	..	Tube of wood or paper covered with cloth.
2,907	1870	..	Tube of gut, closed by rubber disk.
3,019	1870	12	Shell riveted down at rear of base ring.
3,257	1870	12	Blank cartridge. Plug with central elastic pad.
3,373	1870	..	Metallic butt, and xylonite tube, or base of hide, horn, &c., cemented to tube.
3,376	1870	12	Same as 1,829,1870.
409	1871	12	Accelerating. Case formed like a thimble with shoulders.
608	1871	12	Case molded from pulp.
639	1871	12	Metallic shell, to which bullet is flexibly connected.
766	1871	12	Shell has additional disk of metal on base.
1,098	1871	..	Inner surface of shell has raised ridges, or metallic ring or coil, to prevent leading of bore.
1,180	1871	..	Tube of wood, covered with paper or fabric.
1,425	1871	..	Base of soft metal, cast in soapstone mold. Stearine for gas-check and lubricant.
1,572	1871	12	Drawn shell with solid flange. Base may be separate.
1,718	1871	12	Annular space around hub of solid metal shell.
1,811	1871	12	Case of paper—base cup metal.
2,007	1871	..	Tinned metallic shells.
2,283	1871	12	Sheet metal shell, with strengthening base. Fulminate hardened by sand or glass.
2,359	1871	13	Tube of coiled metal or paper—solid head.
2,454	1871	..	Metallic case attached to, and fired with bullet.
3,318	1871	..	Strap attached to cartridge to show that gun is loaded.
21	1872	13	To contain compressed air or liquefied gas.
343	1872	13	Tube has endwise play in base-piece.
895	1872	13	Shot inclosed in spirally wound wires.
1,697	1872	..	Cap or tip formed of glue and varnished.
1,825	1872	13	Conical base.
2,228	1872	13	Tube and base in separate parts. Tube intended to retain wads.

No.	Date.	Plate.	Description.
2,354	1872	13	Elastic disk at rear to prevent explosion in magazine.
3,065	1872	13	Metallic, reinforced or not, with separate base screwed or riveted to tube.
3,186	1872	13	Case of sheet metal, preferably tin plate, with wrought-iron base, the whole coated with tin.
3,195	1872	..	Solid head having depression which engages projection on tubular body.
3,914	1872	13	Cap chamber closed by plug which screws into base-plate.
369	1873	13	Base cup perforated to allow tube to expand into holes
386	1873	13	Cap chamber formed in wad by pressure.
548	1873	13	Has greased pasteboard bullet-cup for lubrication.
1,348	1873	13	Case of gold-beaters skin dipped in collodion.
1,523	1873	..	Hollow cylindrical cartridge, to pass over rifled central rod.
1,549	1873	13	Shell extends forward over bullet.
1,892	1873	13	Fulminate in recessed wad at rear of projectile.
2,299	1873	..	Base lined with a fibrous material, to retain heat.
2,302	1873	..	Shells of iron, steel, copper, brass, &c., nickel-plated.
2,397	1873	..	Pasteboard, pulp, or skin, treated with water-glass.
2,461	1873	13	Concave face forward of flange.
3,537	1873	13	Electro-deposited shell, electro-plated with gold, silver, nickel, &c
3,636	1873	13	Tube of metal, bent and seamed. Metallic base and washer.
194	1874	..	Base of body tapers. Separate head riveted to tube.
654	1874	13	Head of shell thickened.
803	1874	..	Drawn from thin metal. Portion of the metal made to reinforce base by the action of dies.
1,145	1874	..	Cases, wads and sabots made from asbestus paper.
1,275	1874	13	Skin or gut treated with collodion.
1,463	1874	13	Case of flexible material.
1,536	1874	..	Solid flange, metallic.
2,727	1874	..	Case of metal foil and caoutchouc.
3,129	1874	..	Inner and external surfaces of metal shell made concentric.
3,496	1874	13	Metallic shells with longitudinal ribs and grooves.
3,822	1874	13	Shell has two external reinforcing cups.
4,058	1874	14	Paper case—metallic head having radial corrugations.
4,073	1874	13	Metallic tube, covered with rubber.
125	1875	14	Annular groove in reinforce cup.
230	1875	..	Steel plates coated with tin, copper, or nickel drawn up into cartridge shells, or steel shells coated with tin or electro-plated after being drawn from blanks.
1,072	1875	..	Shot inclosed in metallic case or woolen bag.
1,396	1875	..	Cap in eccentric recess in base of cartridge.
1,420	1875	..	Shell has recess at rear for nipple and cap.
3,038	1875	..	Metallic. Tube slit to allow expansion.
3,882	1875	14	Toy cartridge. Projectile contains charge.
2,440	1876	14	Shell turned in and then turned out to form flange.
2,816	1876	14	Metallic shell, or paper tube with metallic base. Internal tube with slot in the end carries fire from cap well into the powder.

NOTE.—Where no plate is designated it will be understood that the cartridge is not illustrated in the patent.

CARTRIDGES—ENGLISH. PLATE 1.



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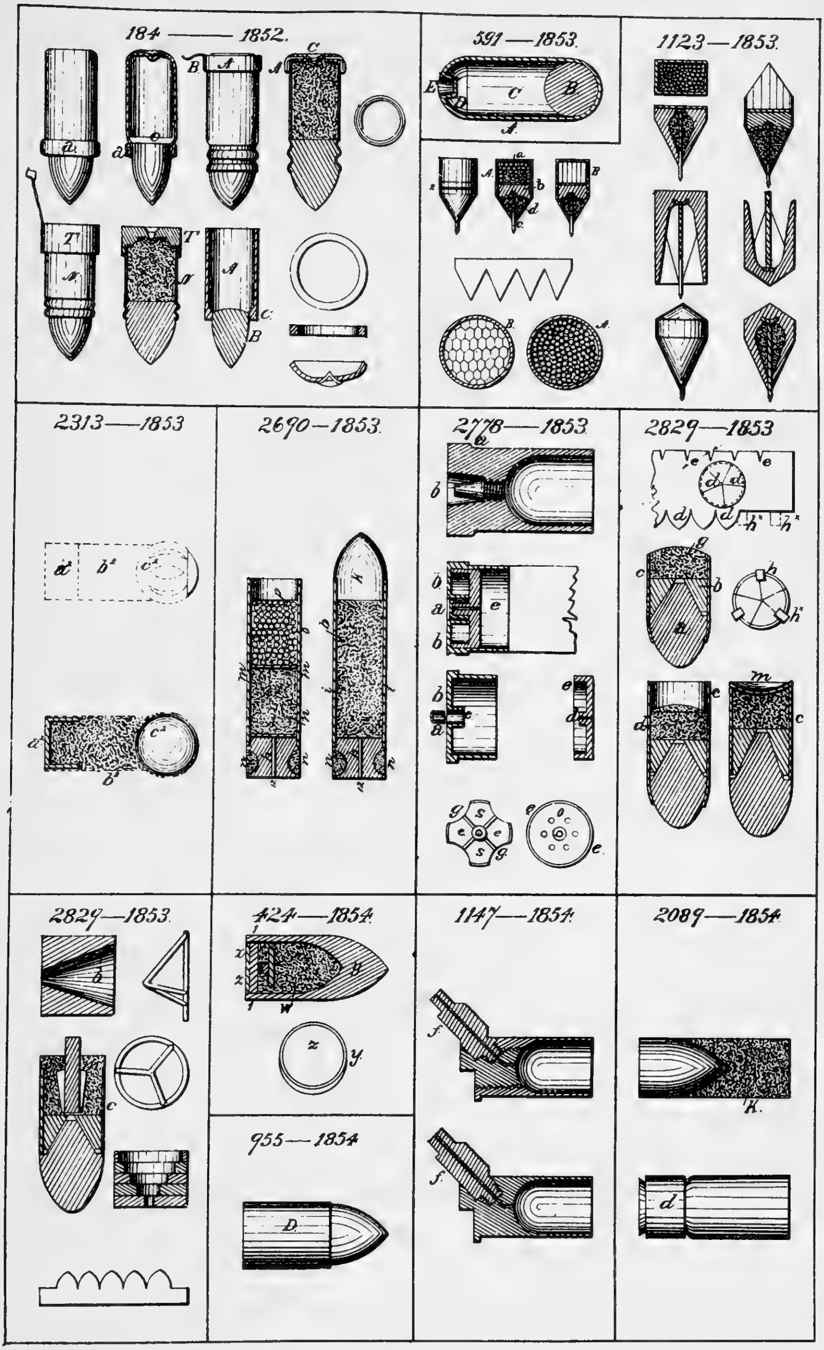
CARTRIDGES—ENGLISH. PLATE 2



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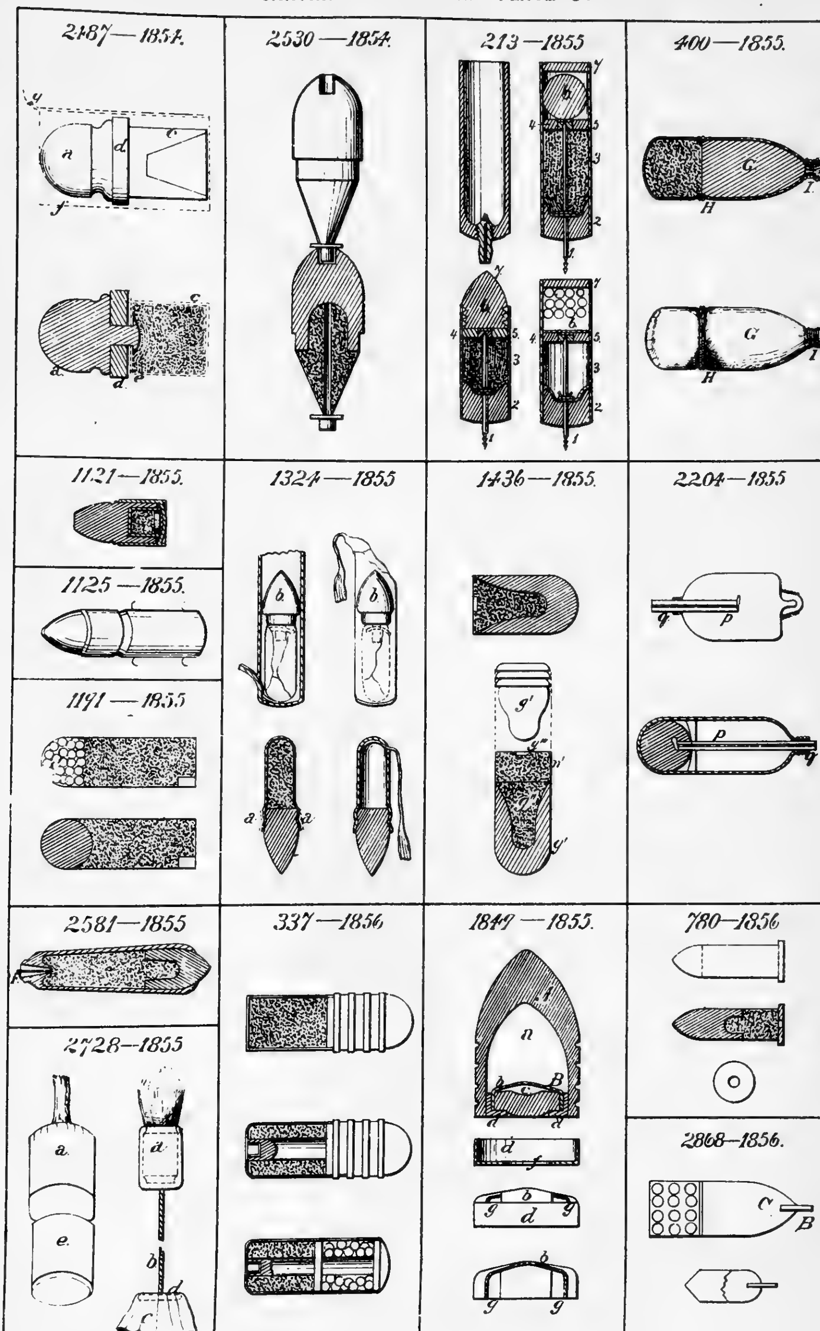
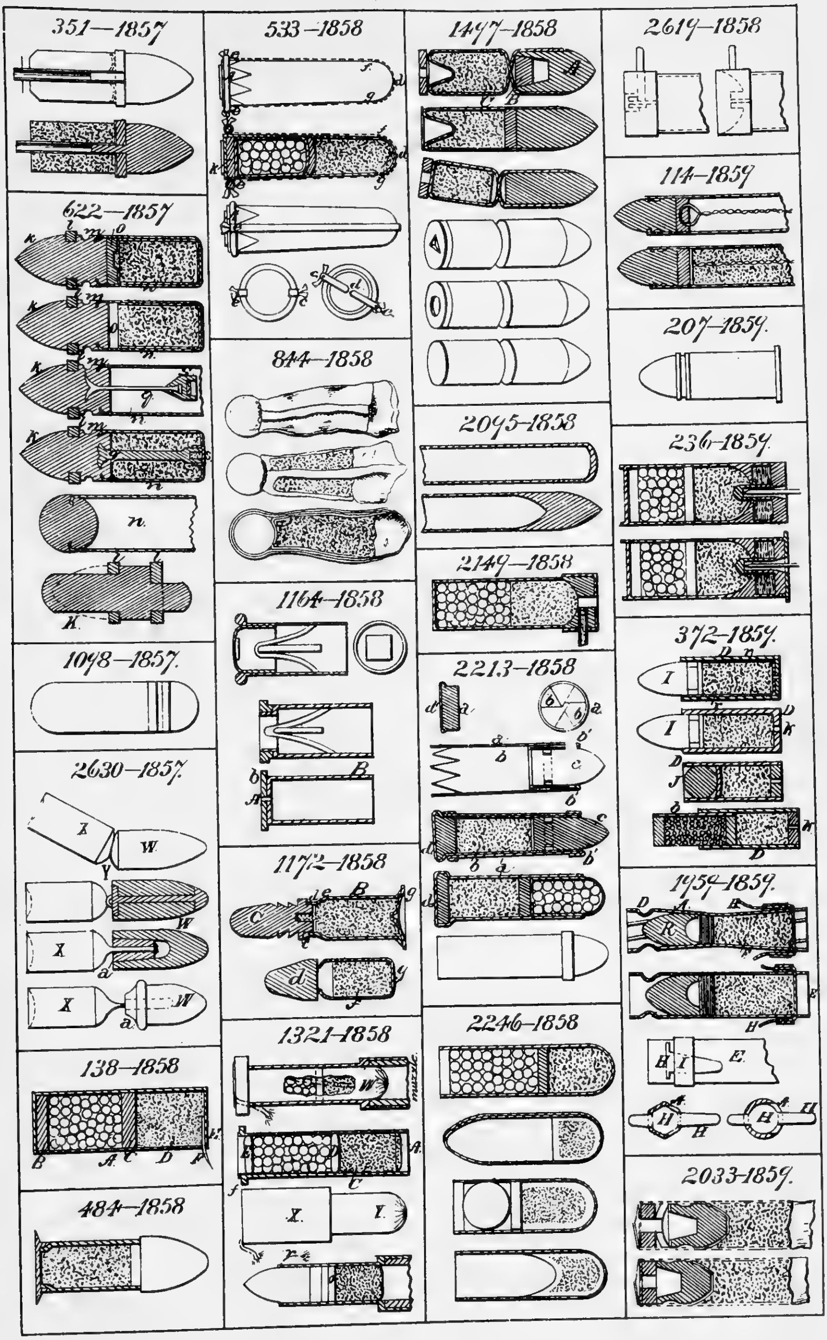
CARTRIDGES—ENGLISH. PLATE 3.



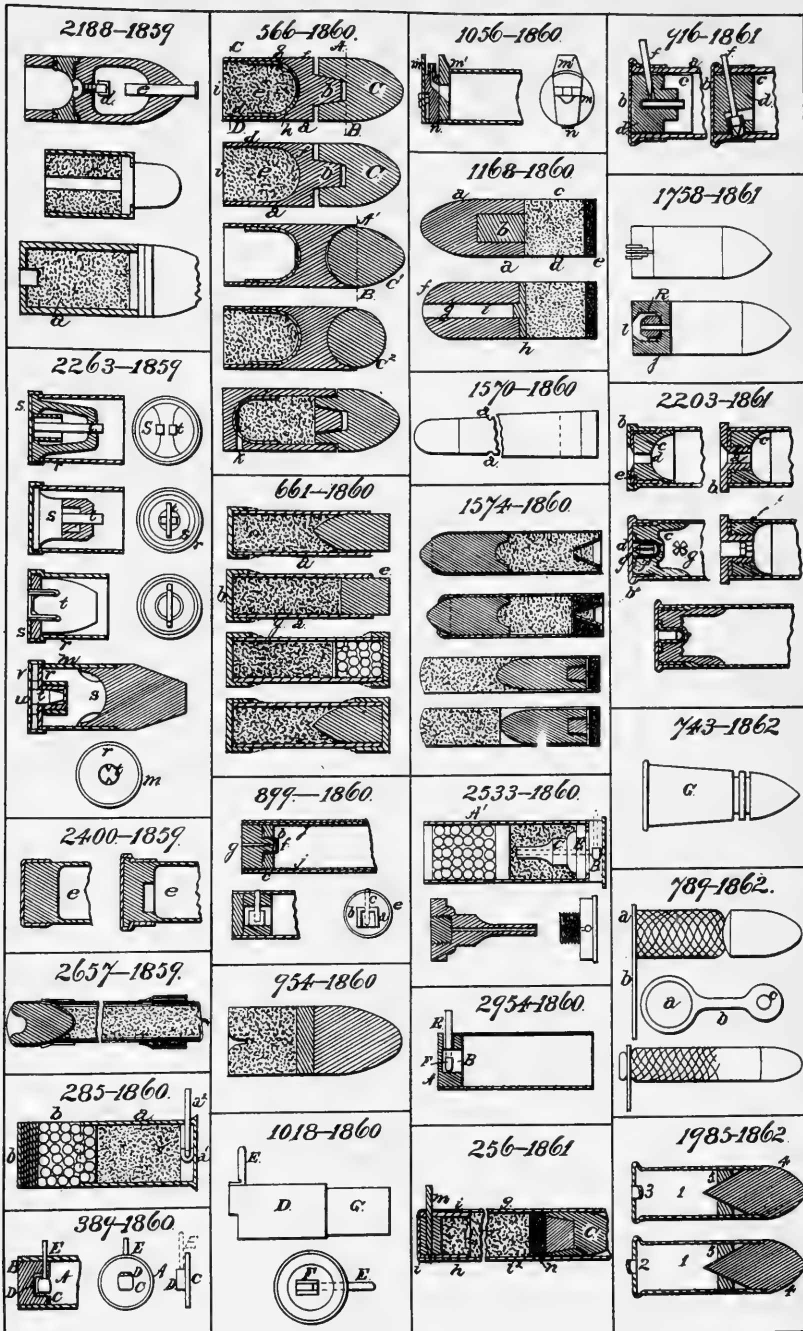
F B Brock Del

CARTRIDGES—ENGLISH. PLATE 4.



P.B Brock Del.

CARTRIDGES—ENGLISH. PLATE 5.



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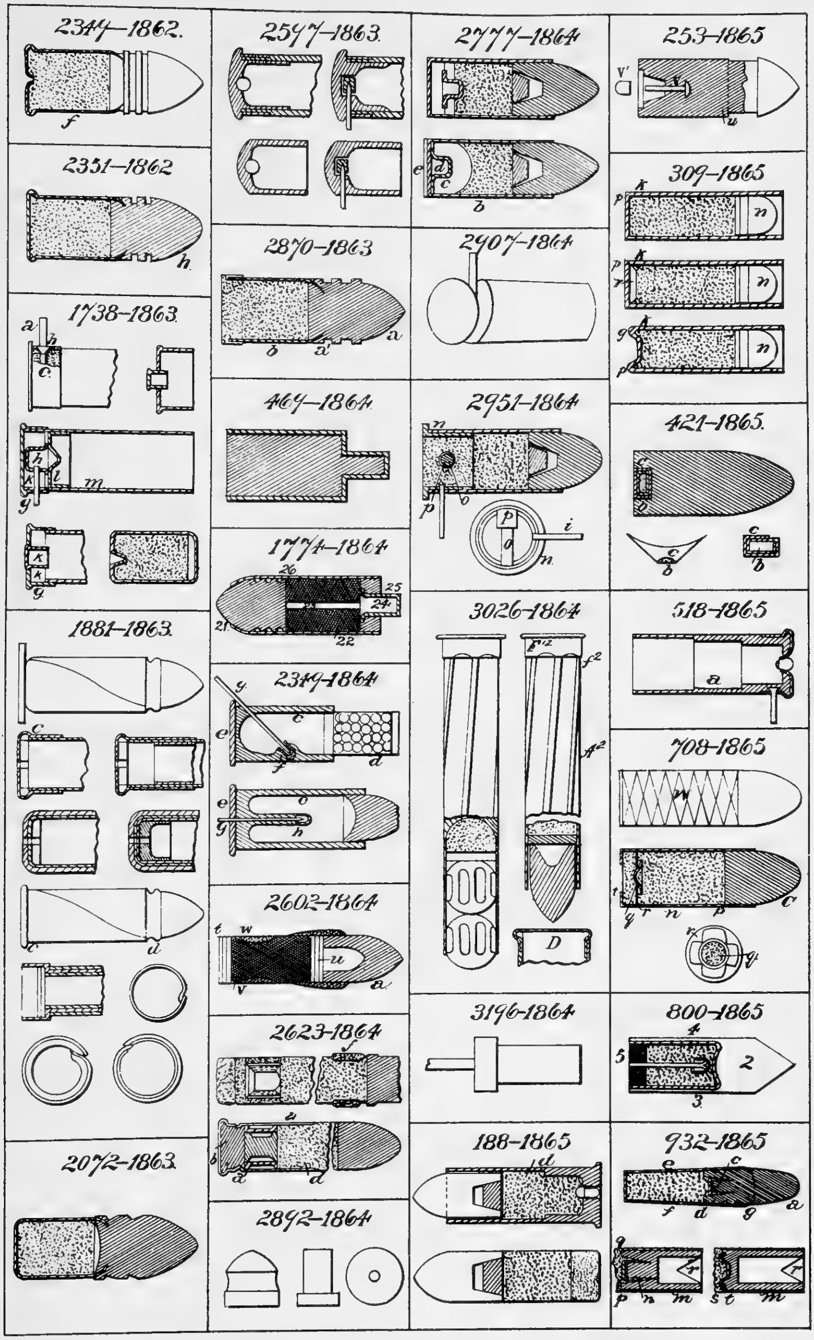
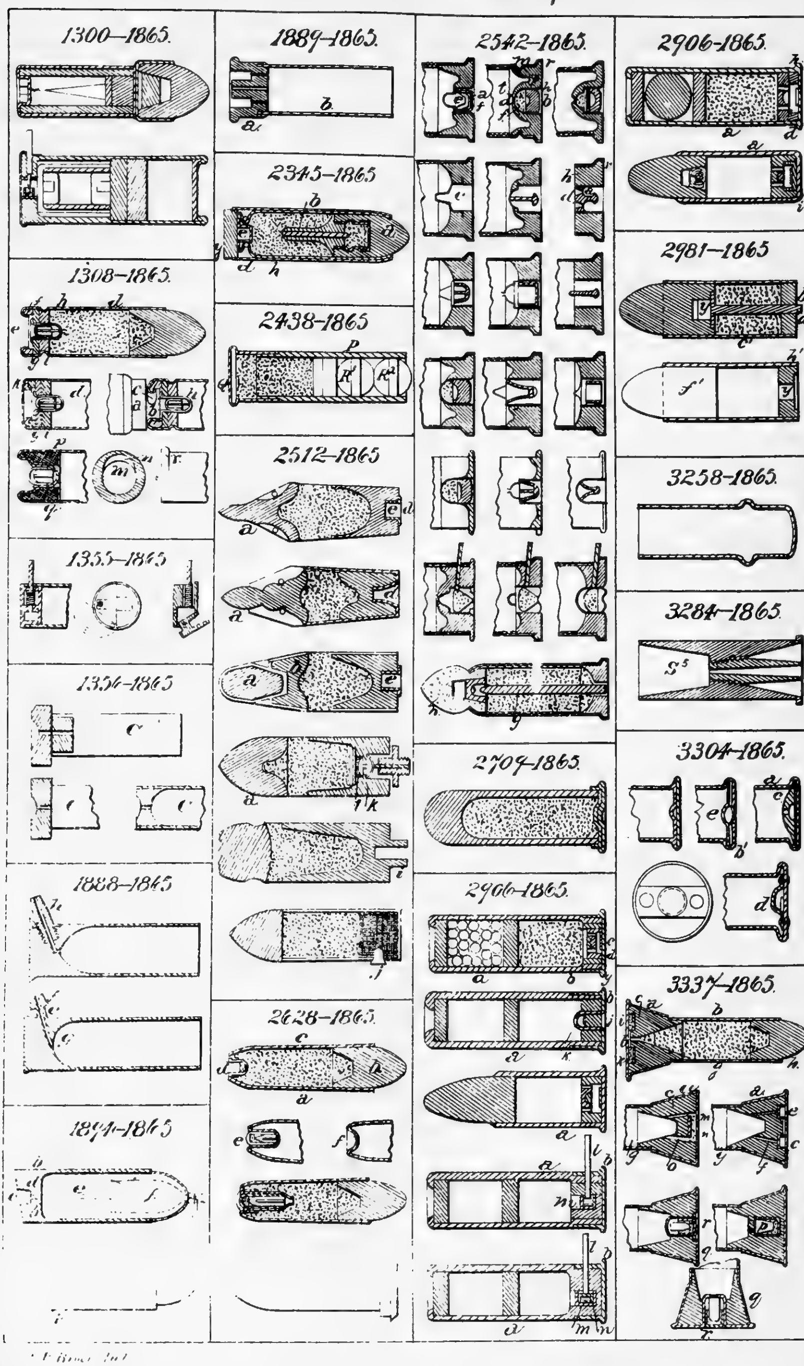
CARTRIDGES—ENGLISH. PLATE 6.



F.B Brock Del.

CARTRIDGES—ENGLISH. PLATE 7.



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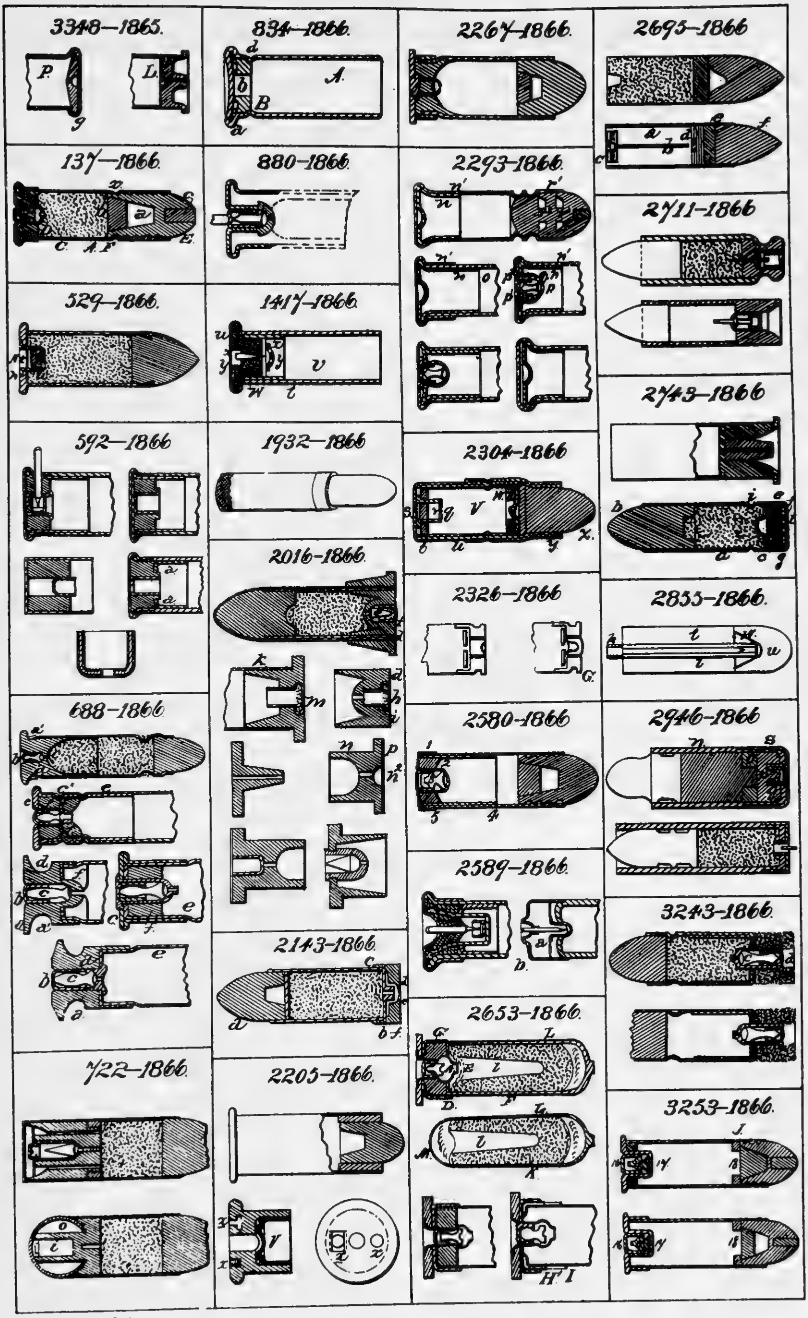
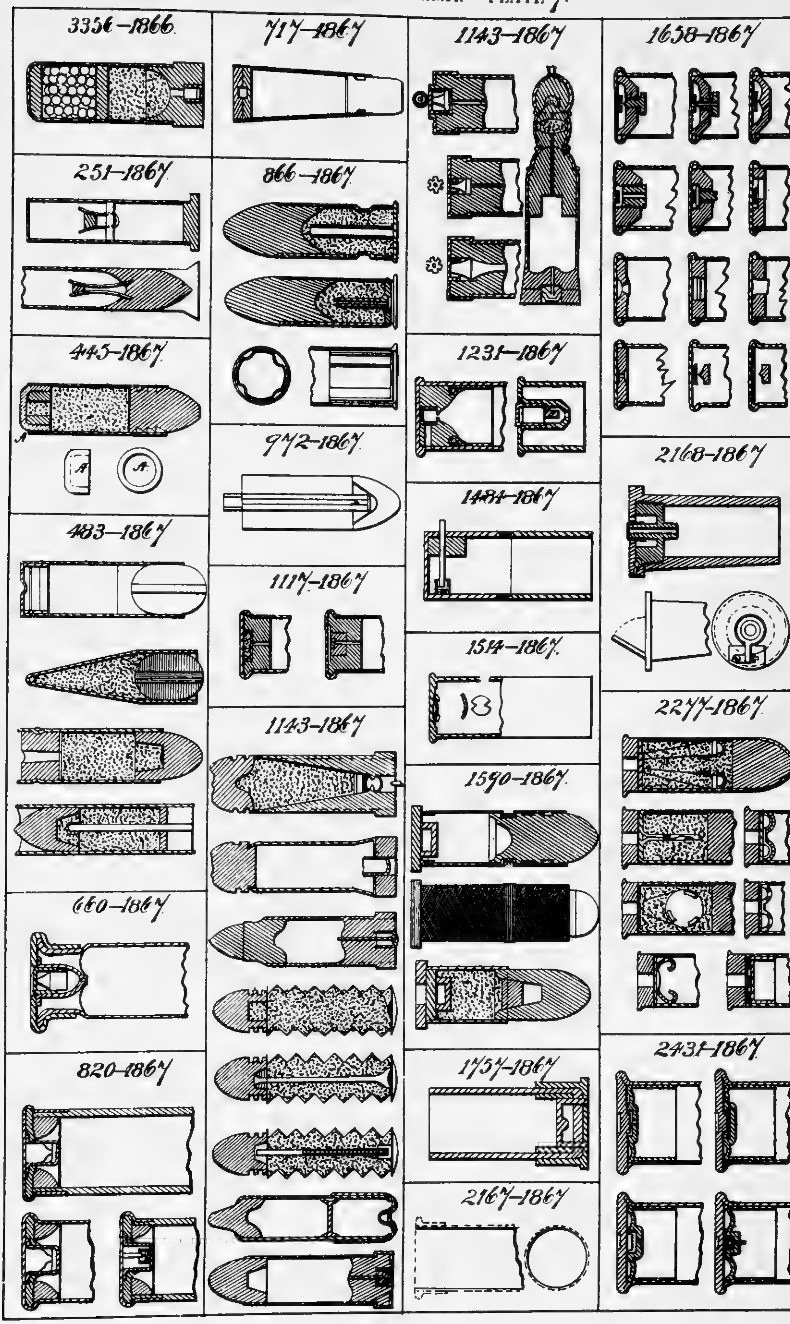


F. B. Brock Del

CARTRIDGES—ENGLISH. PLATE 9.



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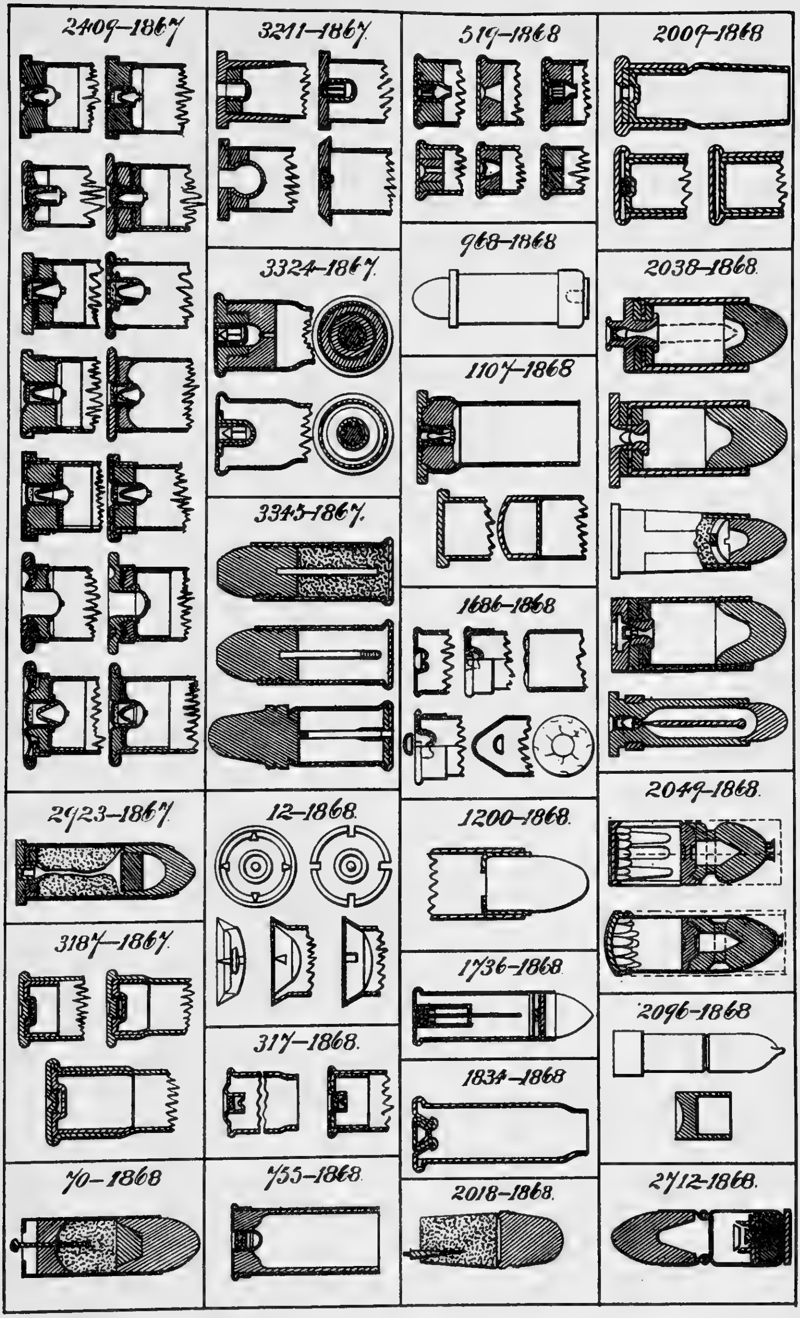
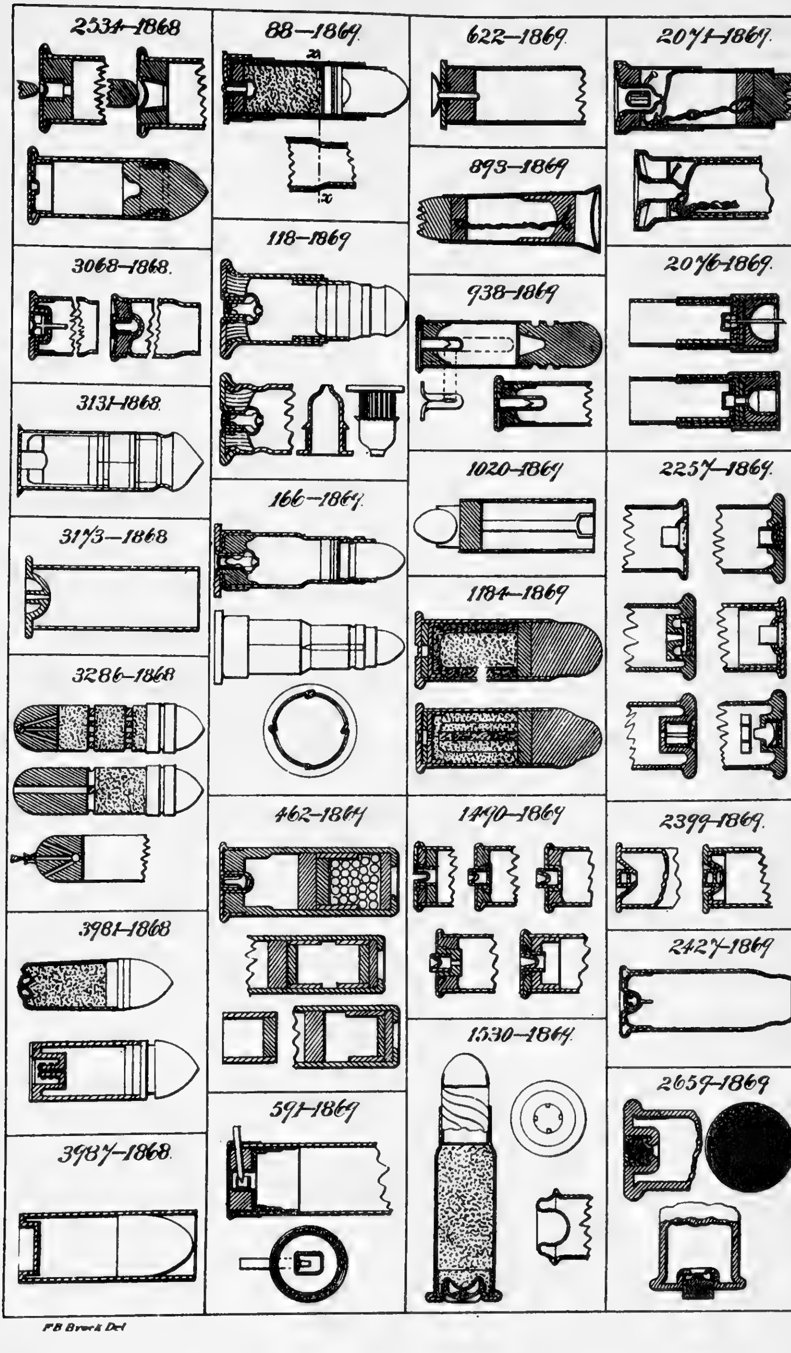


F.B Brock. Del

CARTRIDGES—ENGLISH. PLATE 11.



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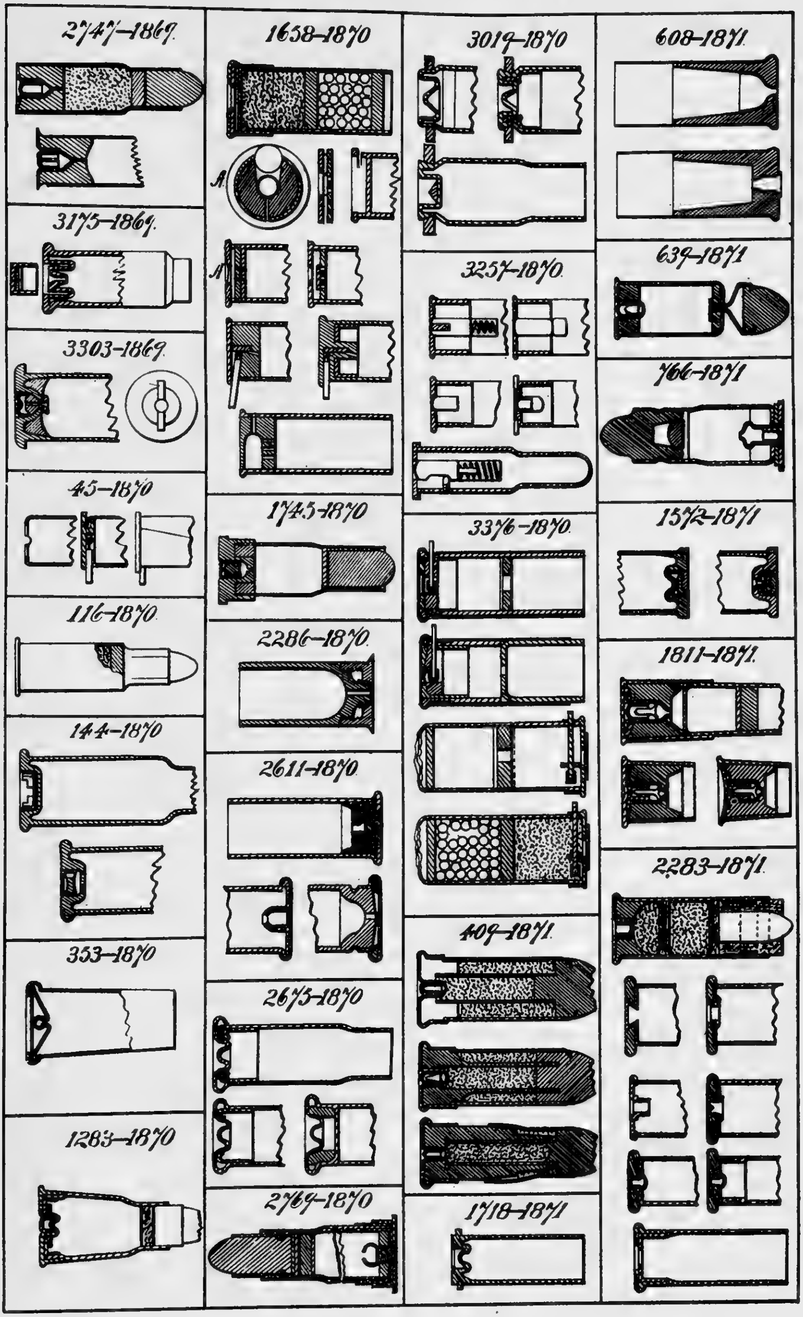
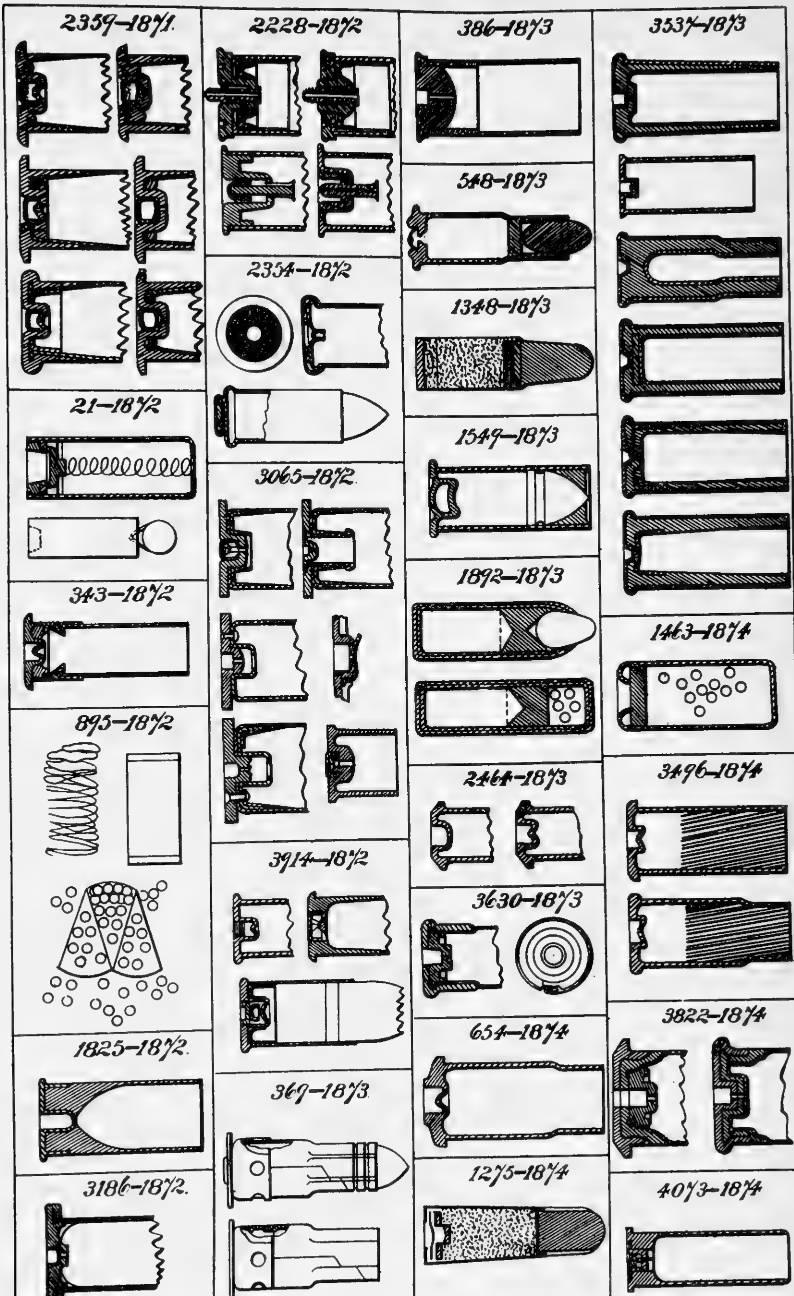


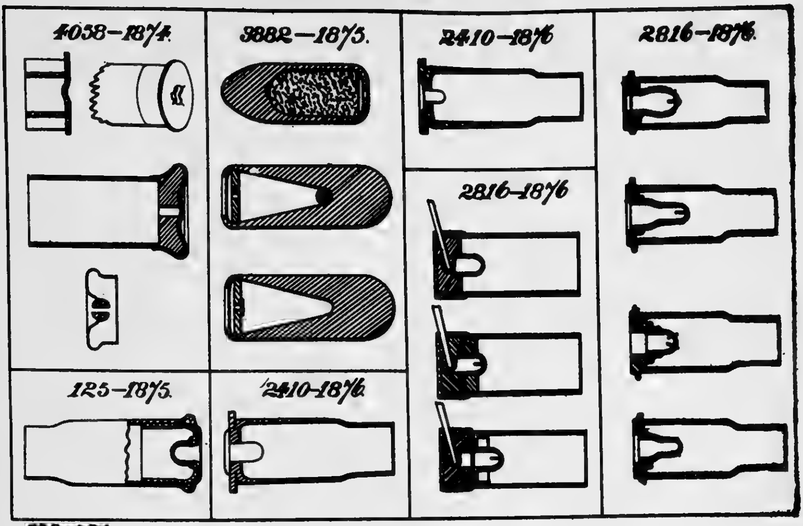
F. B Brock, Del.

CARTRIDGES—ENGLISH. PLATE 13.

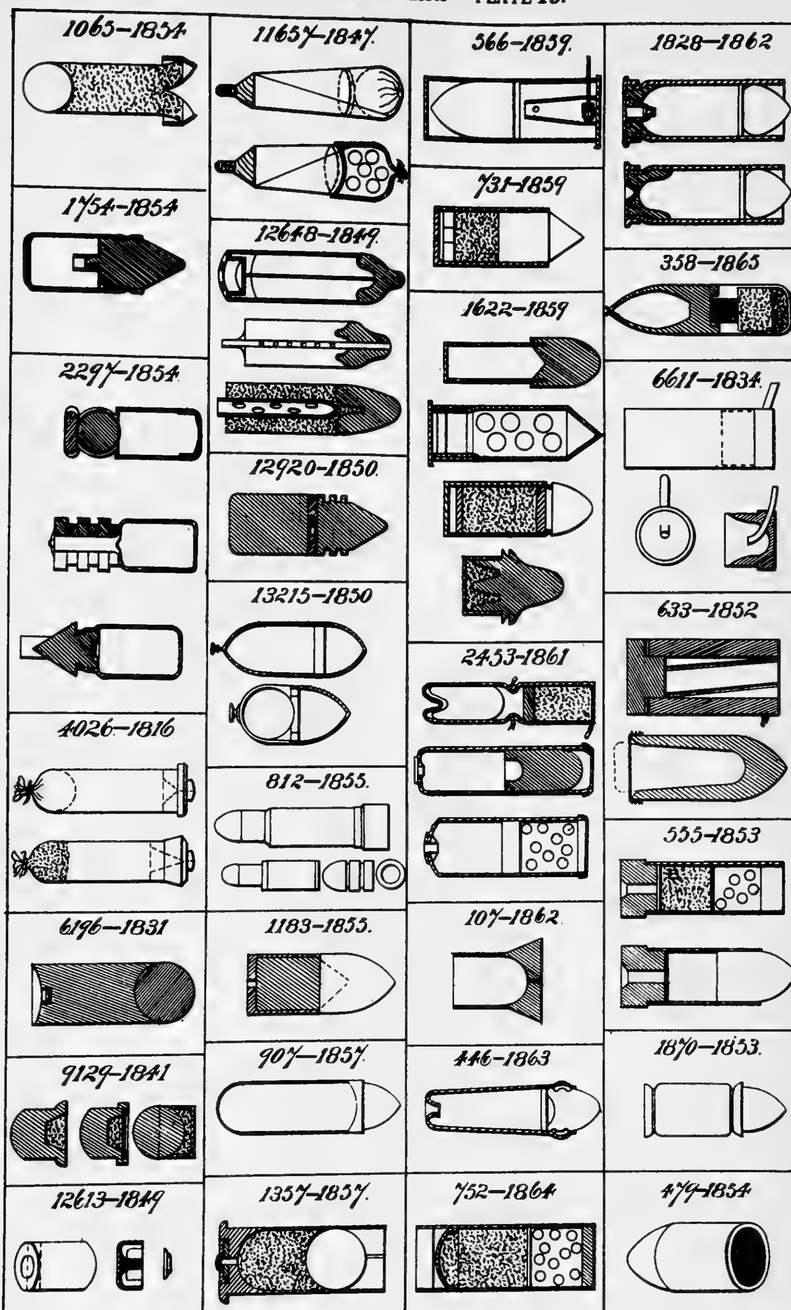


F.B.Brock. Del.

CARTRIDGES—ENGLISH. PLATE 14.



CARTRIDGES—ENGLISH PLATE 15.



F.B. Brock Del

APPENDIX 3

DIGEST OF CARTRIDGES

(*For Small Arms*)

PATENTED IN FRANCE,

PUBLISHED PRIOR TO 1878.

2,025.—Delabourse, Plate 1. Cartridge has a false base which adapts it for use to turn a breech-loader into a muzzle-loader.

2,800.—Renette, Plate 1. Case of wood, pasteboard, or metal, from which charge is emptied into gun.

3,355.—Galy-Cazalat, Plate 1. Case of leather or parchment. Priming in depression in base.

3,930.—Pottet, Plate 1. Removable base has fulminate in pocket or on nipple.

4,411.—Renette, Plate 1. Cartridge for breech-loader; may be self-primed.

4,636.—Plomdeur, Plate 1. Metallic. Cap on teat projecting from side of base.

4,642.—Jourdan, Plate 1. Cap attached to base of paper case, to be removed and placed on nipple of gun.

5,032.—D'Est. Plate 1. (See English Patent 6,139, 1831.)

5,468.—Lepage, Plate 1. Paper tube—metallic base.

6,887.—Colin, Plate 1. Priming in teat projecting from base.

7,172.—Desnyau. Plate 1. Metallic, with nipple at base for cap.

7,573.—Jarre fils, Plate 1. Shell of iron or copper, with side cup for priming.

7,728.—Charoy, Plate 1. Case of paper or fabric.

8,061.—Robert, Plate 1. Primed shell of fusible alloy.

8,829.—Beringer, Plate 1. Metallic. May have permanent nipple, or may have a removable base which is screwed in

9,005.—De La Rachee, Plate 1. False breech, serving purpose of cartridge.

10,890.—Guerin, Plate 1. Cartridge in the nature of a projectile, contains a vial of chemicals which, when the vial is broken in a wound, will cause the death of the animal.

11,863.—Robertson, Plate 1. Envelope of spirally wound paper.

SECOND SERIES, LAW OF 1844.

76.—Michalon, Plate 2. Ordinary cartridge with cap projecting from base.

106.—Guillemin, Plate 2. Case of paper or fabric.

1,936.—Houllier, Plate 2. Pin fire. Cap in disk at base. Copper base cup covered with paper or pasteboard.

2,600.—Menage, Plate 2. Paper case.

2,746.—Loron, Plate 2. Metallic or paper tube with wooden base.

3,321.—Bourcier, Plate 2. Flanged shell has nipple screwed in, or placed in an inclined recess in base.

3,601.—Chaudun, Plate 2. Shell of copper, brass, or paper, with base disk of type-metal covered by copper base cup or cups. Cap made waterproof by resin.

3,946.—Palmer, Plate 2. Powder in projectile retained by metallic cup, or powder in paper or wooden case.

3,952.—Leroy & Mathieu, Plate 2. Paper case; which may have perforated tube extending into powder.

4,084.—Pottet, Plate 2. Shot cartridge.

4,088.—Lenoir, Plate 2. Paper case, or copper shell with nipple screwed in base.

4,839.—Lefaucheux, Plate 2. Copper tube, with copper base screwed in. Pin fire. (Addition to patent.) Base cup and paper tube are joined by internal reinforce or ring.

4,909.—Beringer, Plate 2. Shell may be of zinc, or may be a lap-jointed tube of thin metal, lap jointed to metal base. Cap in perforated wad of pasteboard and metal, in base, or between inside diaphragm of metal and the base of cartridge.

5,545.—Beringer, Plate 2 Metallic tube with metal base cup carrying cap in wad in front of base, and a perforated diaphragm in front of wad to serve as anvil. A modification carries fulminate on projection from base of bullet, and may have a paper case with wad of caoutchouc in base.

7,724.—Bourdon, Plate 2. Paper turned in over front wad. Base cup of metal or pasteboard.

8,273.—Marston, Plate 2. (See U. S. patent 8,966.)

8,290.—Macintosh, Plate 2. Cartridges have communication through them to carry spark of explosion from front. A number of cartridges placed in a gun are fired in rapid succession by front ignition.

8,340.—Devoir-Leclercq, Plate 2. Metallic, or paper tube with metal base. Pin fire. Base of powder chamber may be made conical by inserting wad with central cavity.

9,054.—Riera, Plate 2. (See English patent 1,123, of 1853.)

9,058.—Gastinne, Plate 2. (See English patent 2,778, of 1853.)

9,241.—Needham, Plate 3. (See English patent 184, of 1852.)

9,255.—Bourcier, Plate 3. Nipple screwed into base from inside, and contains firing pin and anvil.

9,271.—10,362.—Dufour, Plate 3. (See Eng. patent 1,147, of 1854.)

9,335.—Gevelot, Plate 3. Crown of paper between two cups of copper.

9,686.—Boche, Plate 3. Wound paper case and wad; metallic base.

10,304.—Perry, Plate 3 (See English patent 2,313, of 1853.)

10,348.—Francotte, Plate 3. (See U. S. patent 18,143.)

10,381.—Gastinne, Plate 3. Central aperture for passage of flame from gun cap.

10,446.—Roussel, Plate 3. Fulminate between metallic disks at base of cartridge.

10,482.—Gevelot & Lemaire, Plate 3. Paper case. Metallic base cup.

10,519.—Gastinne, Plate 3. Fulminate in pocket in base wad.

10,698.—Gaupillat, Plate 3. Primer in base of bullet.

10,831.—Lefaucheux, Plate 3. Cap between bullet and projection from shell, or between shell and projection from bullet.

10,879.—Palmer, Plate 3. (See English patent 424, of 1854.)

11,404.—Prelat, Plate 3. Case of paper or metal foil, with wad of leather at base. Cap near base of bullet, resting on rod extending from base.

11,478.—Gastinne, Plate 3. Paper case with base wad of caoutchouc.

11,514.—Chasseboeuf, Plate 3. Shot cartridge. Base wad of wood or metal. Case slitted in front.

12,100.—Grenu, Plate 3. Paper tube; metallic base cup having nipple for cap.

12,603.—Gevelot, Plate 3. Paper tube and reinforce, metallic base cup. A wad of wound paper surrounds priming pocket.

12,746.—Pottet, Plate 3. Paper case; metallic base disk having priming tube which screws into concave base wad.

12,965.—Chaudun, Plate 3. Shot in wound paper tube, with the ends of the tube turned over end wads. This shot cartridge fits the paper cartridge case, which latter may have disk of caoutchouc in base.

12,975.—Prince, Plate 3. Paper case, with pocket in base in which cap is placed, and may be held by cement.

13,210.—Needham, Plate 3. Cartridge made of vulcanized rubber, or of paper or metal tubes, with a rubber base. A metallic cartridge is shown with a projection from one side of the base.

13,660.—Whitworth, Plate 3. (See English patent 1,959, of 1859.)

13,735.—Restell, Plate 3. (See English patent 2,530, of 1854.)

14,490.—Lenoir, Plate 4. Paper case, with base wad of pressed pulp. Fulminate in wad at base of bullet, fired by central needle.

14,550.—Boche, Tordeux & Ouarnier, Plate 4. Paper tube—metallic base.

14,572.—Vincent, Plate 4. Paper case, metallic base cap. May have internal reinforce which forms concave powder chamber.

15,014.—Burnside, Plate 4. (See U. S. patent, 14,491.)

15,187.—Maberly, Plate 4. (See English patent 1,191, of 1855.)

16,322.—Ramscar, Plate 4. (See English patent 2,204, of 1855.)

16,574.—Swyney, Plate 4. Charge contained in bullet.

17,054.—Manceaux & Vieillard, Plate 4. Paper case, with wire extending back to base from bullet.

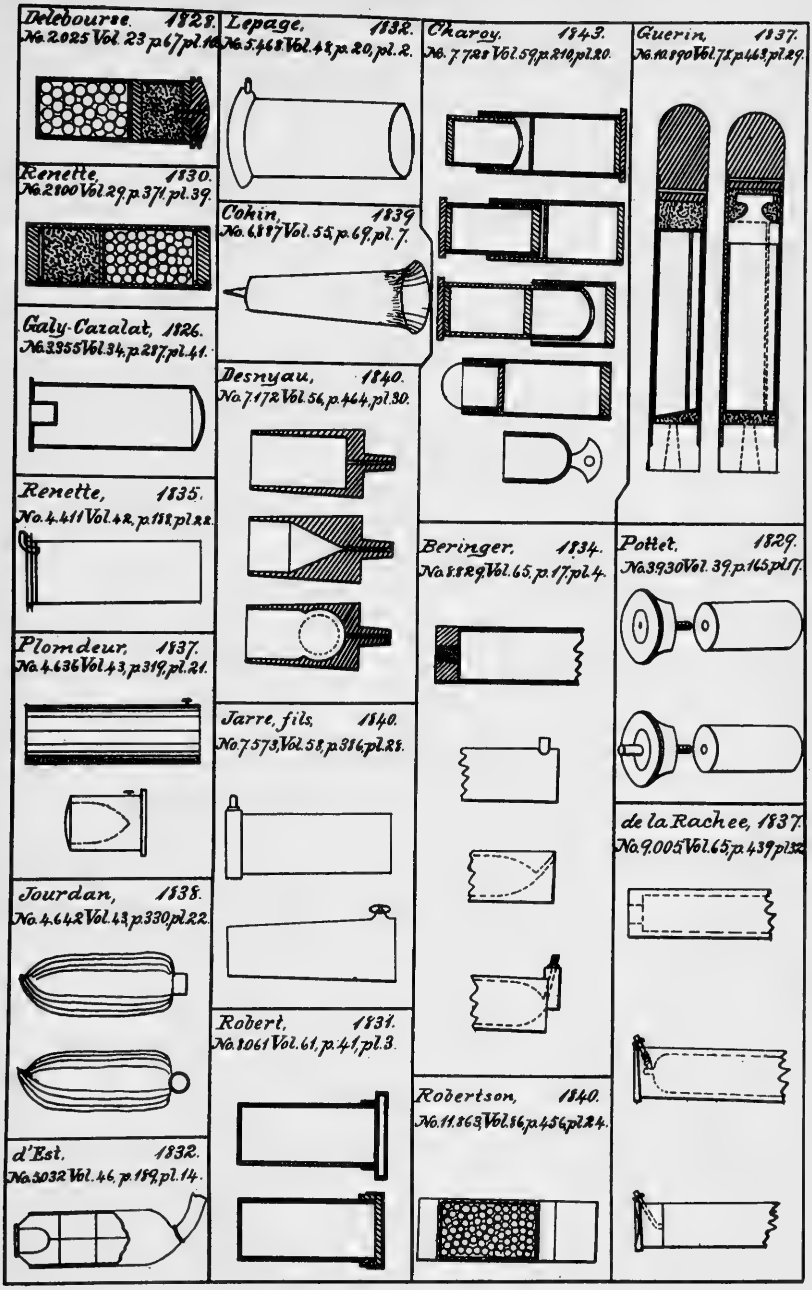
17,392.—Pichon, Plate 4. False breech, to adapt breech-loader for use as muzzle-loader.
17,741.—Perrin, Plate 4. Shot are divided into compartments by longitudinal partitions.
17,830.—Moutier, Plate 4. Charge in projectile retained by primed cup of metal.
18,605.—Porcheron, Plate 4. Paper case—end twisted.
18,612.—Pidault, Plate 4. Case may have base of zinc, iron, or steel, which carries nipple.
19,579.—Lancaster, Plate 4. (See U. S. patent, 18,143.)
20,108.—Houllier, Plate 4. End of tube turned over wad to retain shot.
20,153 —Portalier, Plate 4. Paper case with metallic base. Cap on an anvil which screws either into base of cartridge or base of bullet.
20,308 —Schneider, Plate 4. Metallic, with head screwed on, or paper case turned into metallic base, or between screw head and wad.
20,657.—Restell, Plate 4. (See English patent 2,630, of 1857.)
21,595.—Morse, Plate 4. (See U. S. patent, 20,214)
21,830.—Thomas, Plate 4. Cartridges have ratchet-teeth on one side, to engage with sprockets in magazine.
22,014.—Burnside, Plate 4. (See U. S. patent, 27,791.)
22,099.—Boche, Plate 4. Metallic cup in base, to form a powder chamber which is partly conical. Base wad of paper, caoutchouc, gelatine, or similar substance. Wound paper tube.
22,254.—Gaupillat & Illig. Copper shell, perforated at base, and having cap held in zinc interior disk; or with closed head, and U-shaped anvil with its legs secured in flange.
22,371.—Ouarnier, Plate 4. Paper tube, reinforce, and wad, with copper base cup. A screw entering the base from the side opposite the pin serves as anvil, and to secure the parts together.
22,476...Brown, Plate 4. (See English patent 2,213, of 1858.)
22,636.—Royet, Plate 5. Iron shell, having a nipple. A cartridge entirely of paper is also described.
22,765.—Smith, Plate 5. (See English patent 372, of 1859.)
22,819.—Gevelot, Plate 5. Base wad of pressed paper, having metal lined chamber for cap.
23,132.--Rochaz, Plate 5. Paper case with cap in base wad; or projectile contains charge.
23,200.—Roy, Plate 5. Cap in metal lined pocket in base wad. Metallic reinforce between wad and paper tube. Pin fire.
23,201.—Caron, Plate 5. Self-primed cartridge, center fire.
23,421.—Chaleyer. Pin passes entirely through base, and serves to remove cap after firing.
23,439.—Varlet, Plate 5. Copper base cup has a small external boss of iron, through which pin passes.
23,447.—Gaubert, Plate 5. Metallic. Has a plug in base in which cap is held against internal anvil.
23,473.—Javelle, Plate 5. Shell of tin or iron. Anvil extends from base of bullet or shell.
24,014.—Manceaux, Plate 5. (See English patent 2,033, of 1859.)
24,018.—Le Mat, Plate 5. Paper case fastened to bullet in various ways. Shot cartridge may have metallic shell.
24,035.—Lejeune-Chaumont, Plate 5. Brass, copper, or steel shell, or case of paper or caoutchouc.
24,399.—Henry & Legreze, Plate 5. Cap in wad held in flange of shell
24,511.—Vigne, Plate 5. Paper case with metallic base.
24,521.—Boche, Plate 5. Bottle-necked cartridge.
25,040.—Gauthier, Plate 5. Metallic base plug provided with nipple.
26,422.—Adams, Plate 5. (See English patent 285, 1860.)
26,478.—Chaleyer, Plate 5. Base reinforced by perforated base wad of non-oxidable metal, which contains cap in perforation.
26,901 —Schneider, Plate 5. (No description.)
26,927.—Leme, Plate 5. Paper case with metallic base. Shot charge separated by wads.
26,983.—Marcou, Plate 5. Cartridge has small piece attached at one side of base, to serve as extractor.
48,064.—Franci, Plate 5. Copper base cup has serrated front.
48,069.—Manceaux, Plate 5. Copper shell. Transverse aperture through base wad contains cap and anvil, and is closed by a screw.
49,206.—Chaleyer, Plate 5. Rolled paper tube, with internal metallic disk at base containing cap, and external base cup of metal.
50,346.—Gruyelle, Plate 5. Base disk, having flange, anvil, and pin, is held in tube by a bayonet catch.
50,516.—Jousse, Plate 5. Central tube extending into powder.
50,718.—Spencer & Cheney, Plate 5. Metallic—rim fire.
51,820 —Parent, Plate 5. Tube of paper, or paper and metal foil, or of metal. Cap in base wad. Cap may be plated to prevent oxidation.
51,850.—Lenoir, Plate 6. Paper tube with paper base wad covered by zinc disk. Fulminate at center or in front of powder charge.
52,029.—Gevelot, Plate 6. Paper tube with metallic base cup and wad. Anvil of pressed powder hardened by gums or resin.
52,152.—Descoutures, Plate 6. Center fire cartridge.
52,304.—Chiboust, Plate 6. Tube of metal, paper, or paper and metal, with metallic base cup which carries nipple or primer.
52,459.—Simard, Plate 6. Metallic tubes, split longitudinally, and placed one inside the other, so as to break joints.
53,904.—Chandun & Deriviere, Plate 6. Tube of paper or metal with metallic base cup. Base wad of paper has a nipple screwed therein.
53,182.—Bourry, Plate 6. Case entirely of paper, which is rolled up, and the end turned in and pressed in a die to form base. Shot tube may be made in same manner, and secured inside main tube.
53,465.—Cassegrain & Paschal, Plate 6. Front of tube crimped in.
53,844.—Gastinne, Plate 6. (No description.)
54,899.—Tronchon, Plate 6. Paper tube covered with caoutchouc. Metallic base cup.
55,123.—Hebert, Plate 6. Case of paper or metal, with hinged piece across base to retain cap.
56,057.--Curtis, Plate 6. Paper case.
56,272.—Parent, Plate 6. (See English patent 1,738, of 1863.)
56,838.—Ferlet, Plate 6. Convex metallic base wad covers cap.

(The French patents from 1864 to 1870, inclusive, are not yet published.)

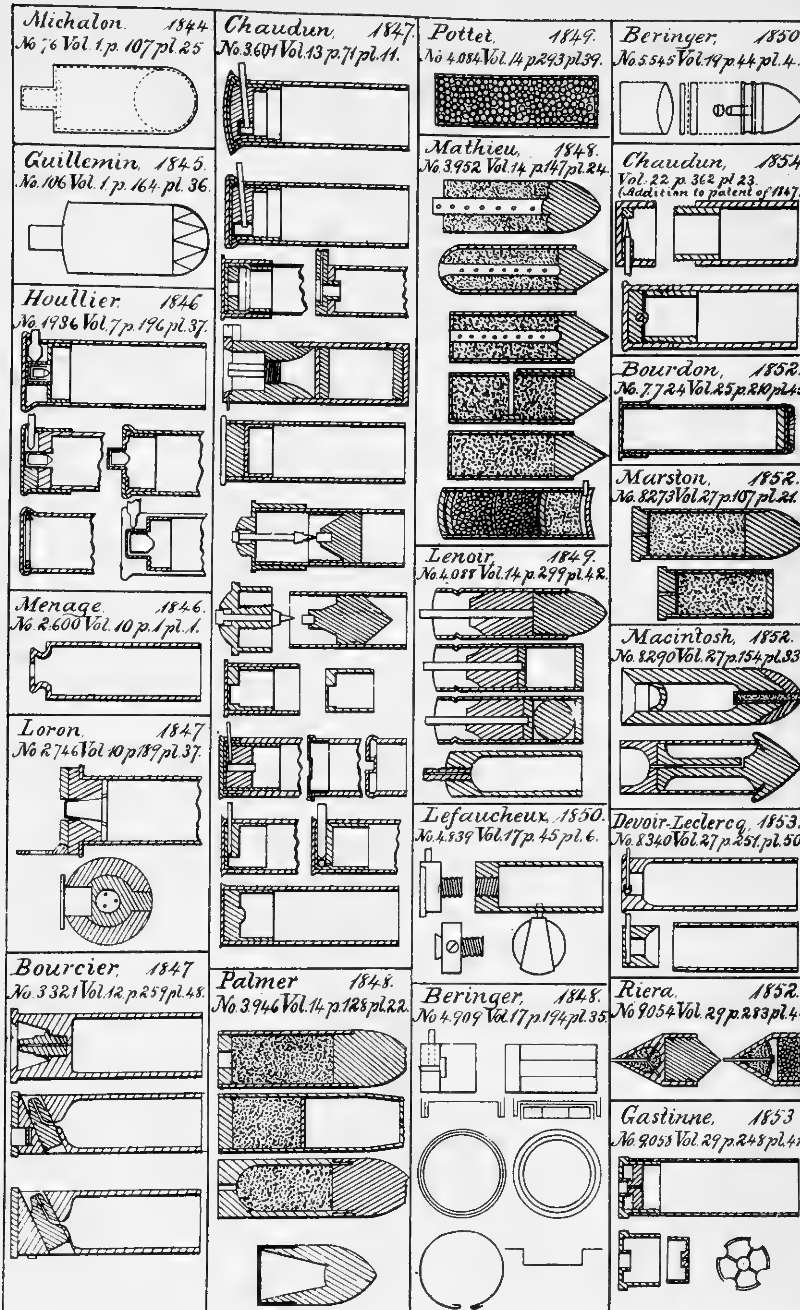
THIRD SERIES,

91,558.—Appe, Plate 7. (No description.)
91,581.—Savy, Plate 7. Paper case with cap in base and anvil extending back from bullet.
91,632.—De Coster, Plate 7. Paper case with wad of caoutchouc in base.
91,640.—Grellet, Plate 7. Projectile contains charge.
91,682.—Samain, Plate 7. Metallic. Nipple screwed in.
91,853.—Wilson, Plate 7. (See English patent 3,019, of 1870.)
91,910.—Nouvelle, Plate 7. (No description.)
91,912.--Rivoire, Plate 7. Paper case, felt base wad.
92,029.—Fitz Maurice, Plate 7, (See English patent 409, of 1871.)
92,170.—Manceaux, Plate 7. (See English patent 1,811, of 1871.)
92,514.—Wilson, Plate 7. (See U. S. patent 159,883.)
92,630.—Hervy, Plate 7. Paper case, which may have paper base, or base cup of leather held between disks of metal.
93,102.—Milbank, Plate 7. (See U. S. patents 125,830, 131,016, and 131,017.)
93,299.—Perraud & Malard, Plate 7. Paper or metal tube with metallic base cup.
93,465...Rivolier, Bouniard & Blanc, Plate 7. Tube of caoutchouc, with metallic base, having projection passing through the end of tube, and an internal nut or washer.
94,070.—Legrand, Plate 7. Wound paper tube with metallic base cup.
94,113.—Appe, Plate 7. Two tubes of tin, (edges not soldered,) one placed within the other. Base wad of paper or metal; or copper shell with external priming pocket.
94,403.—Van Choate, Plate 7. (No description.)
94,480.—Dervieux, Plate 7. Metallic shell, with powder charge divided by perforated wads.
95,623.—Rochaz, Plate 7. Metallic, with wad of paper or other substance in base.
97,157.—Broadwell, Plate 7. Tin tubes, one inside the other, held to base by ferrule having turned-in edges.
97,471.—Richards, Plate 7. (See English patent 3,195 of 1872.) Thin tube of metal expanded into solid head.
97,532.—Manceaux, Plate 7. (See English patent 3,914, of 1872.)

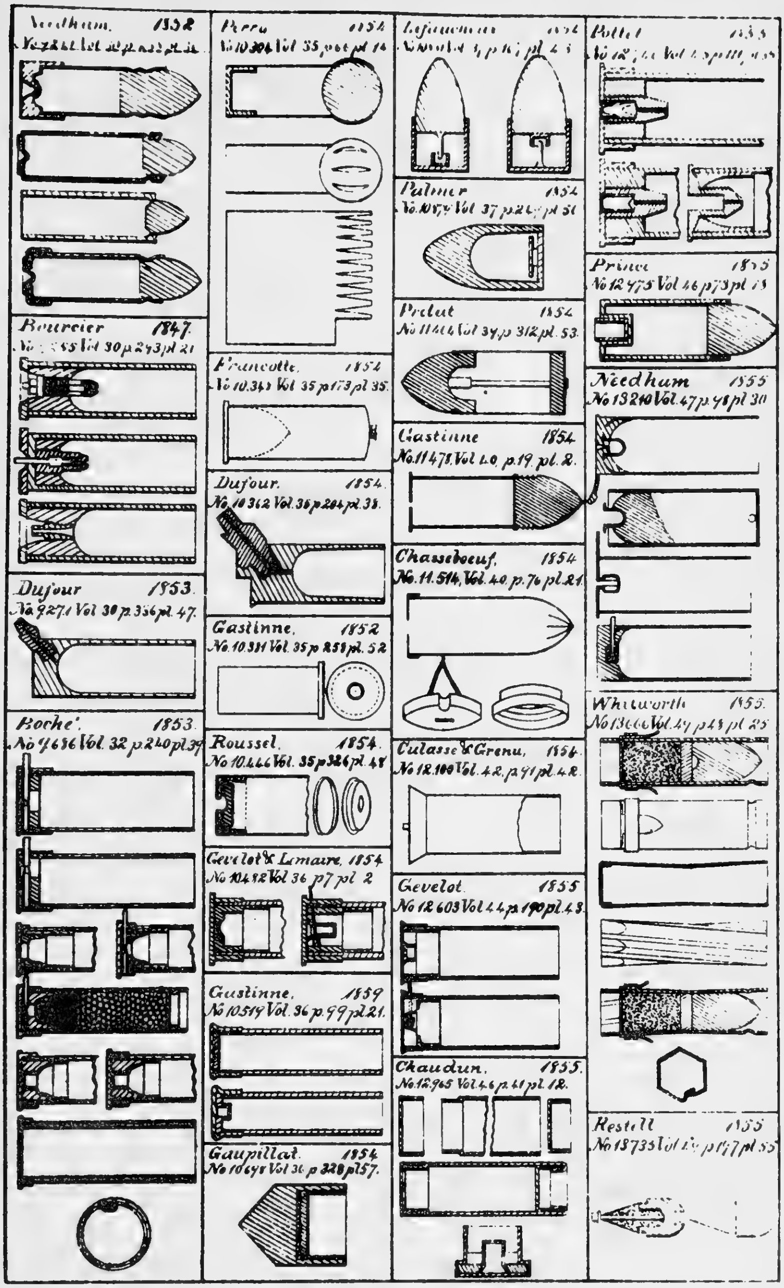
CARTRIDGES—FRENCH. PLATE 1



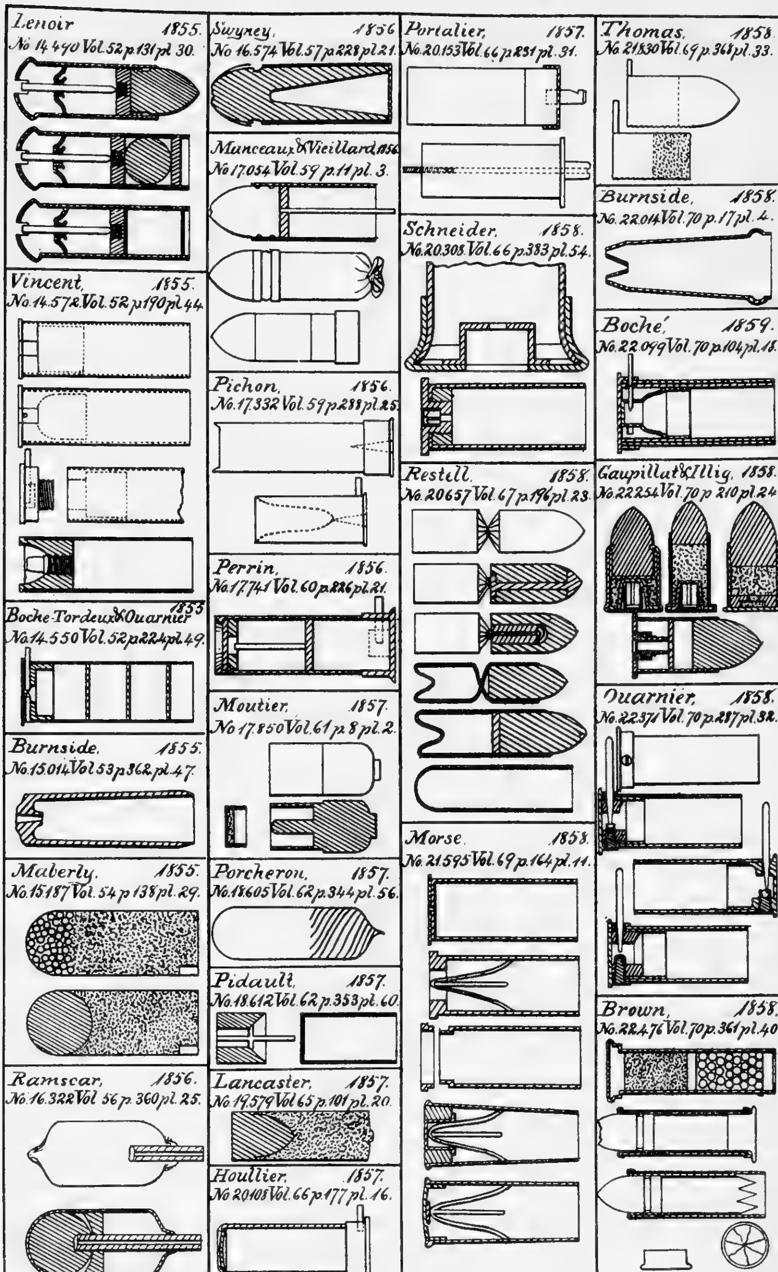
CARTRIDGES—FRENCH. PLATE 2.



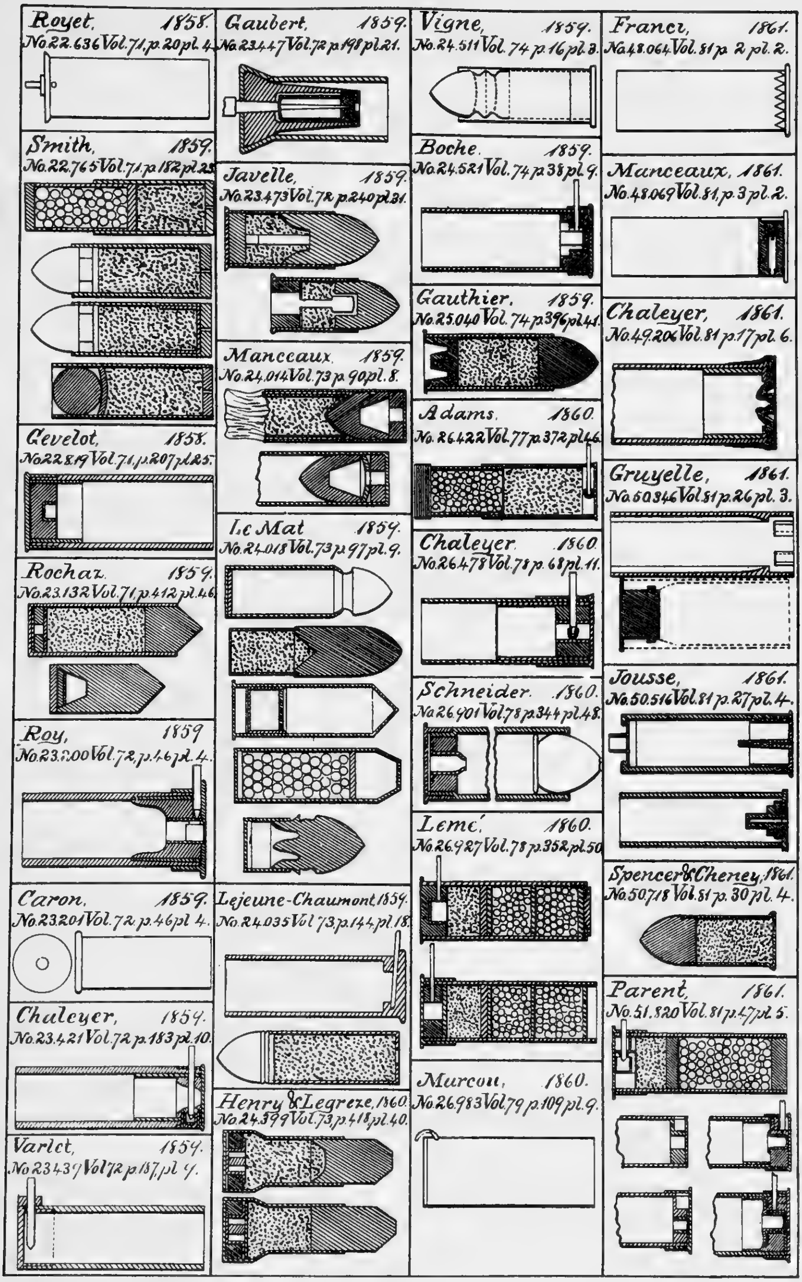
CARTRIDGES—FRENCH PLATE 3.



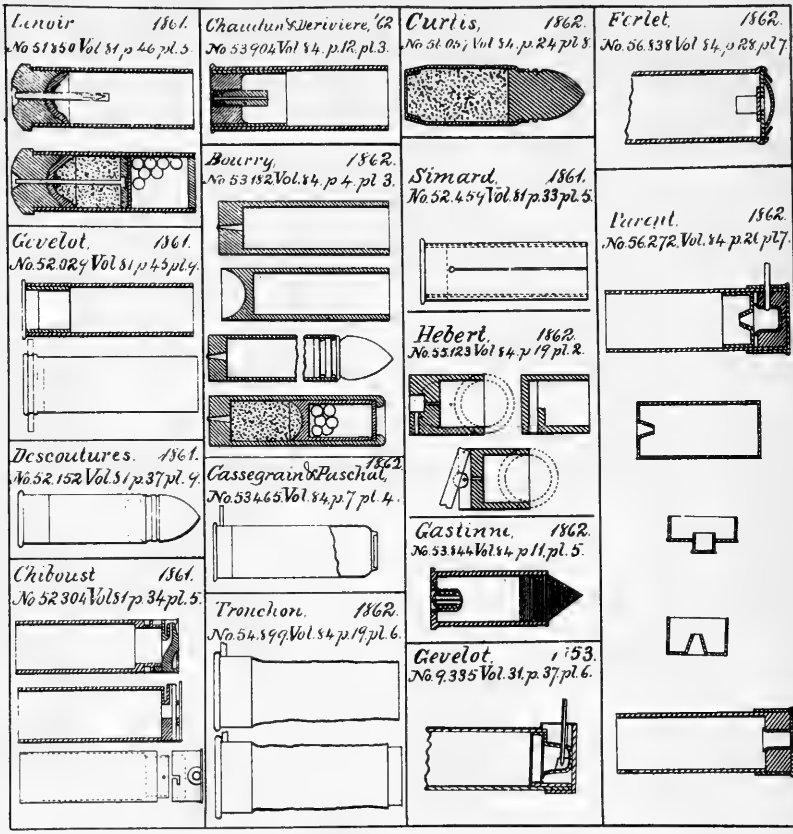
CARTRIDGES—FRENCH. PLATE 4.



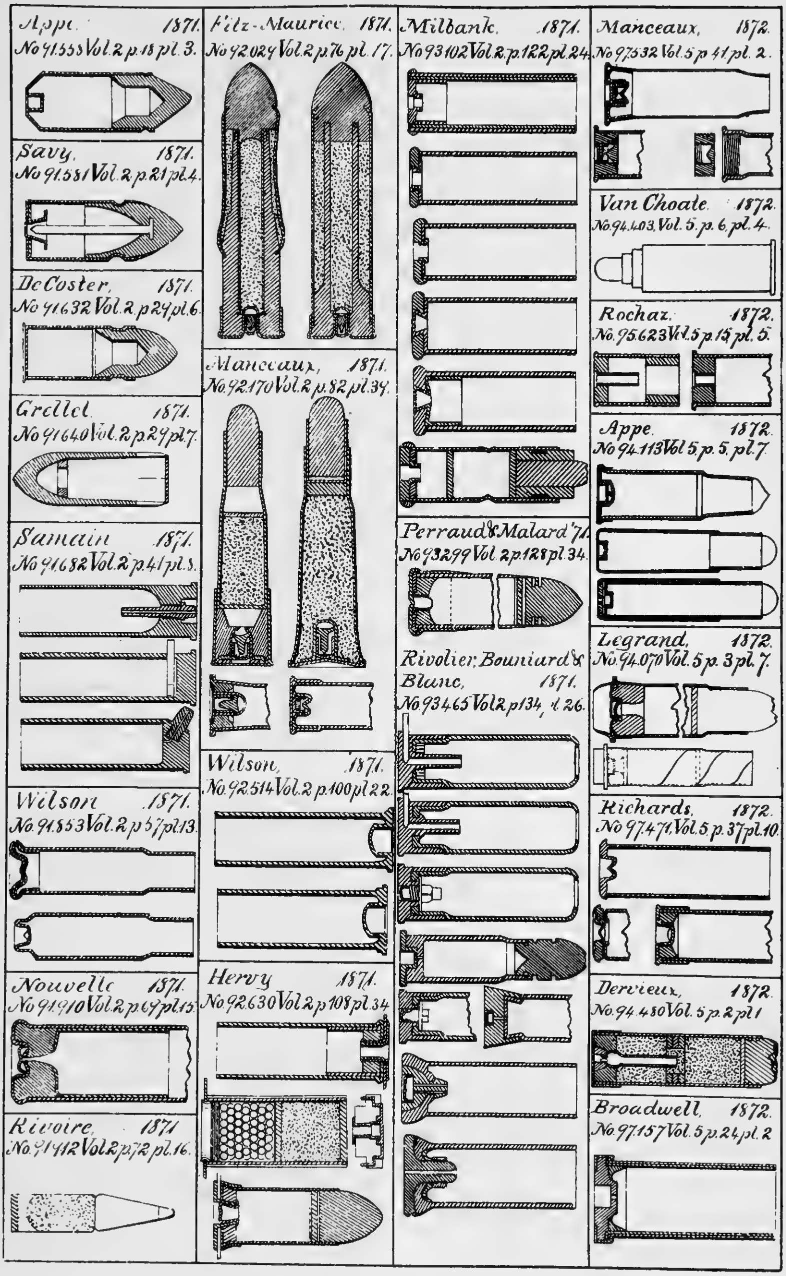
CARTRIDGES—FRENCH. PLATE 5.



CARTRIDGES—FRENCH. PLATE 6.



CARTRIDGES—FRENCH. PLATE 7.



APPENDIX 4

American Firearms Makers During the Colonial Period, as Listed by Charles W. Sawyer in "Firearms in American History," Vol. 1

Virginia: Rapahannock Forge, near Fredericksburg.

Pennsylvania: Peter de Haven, Hugh de Haven, Marmaduke Blackwood (locks), Ebenezer Craig (locks), all of Philadelphia; Evans, Walker, and Williams, of Valley Forge; William Antid and John Baker, of Frederick Township; Michael De Rainer and Adam Deterer, of Lancaster; James Chapman of Bucks County; Dunwicke of Chester County; also Gouger, Matthias Keeley, John Kerlin, Kinder, Benjamin Rittenhouse, Benjamin Town, T. Wickham, and John Willis, locations unknown.

Vermont: Thomas Hill.

Massachusetts: Richard Falley of Westfield; Hugh Orr, and Dike of Bridgewater; "Deacon" Barret of Concord; Thomas Earl of Leicester; Seth Johnson of Old Rutland; Seth Pomeroy of Northampton; Enoch Putman of Granby; Shubabel and Joseph Sever of Framingham; Asa and Andrus Waters of Sutton; Horace White of Springfield; Anos Whittemore of Boston, John Wood of Roxbury; and Martin Eley, Benjamin Guillam, Beman, Gideon Frost, and Shaw, locations unknown.

Rhode Island: Stephen Jenks of North Providence; and Jeremiah Sheffield and George Taft, locations unknown.

Connecticut: Ard Welton of Waterbury.

New York: Waters of Dutchess County.

Maryland: Henry Hollingsworth of Elkton; William Whetcroft of Annapolis; Robert Read of Chesterton; and Richard Dallam, Isaac Harris, John Messersmith, Sterewith, Elisha Winters, and John Yost, locations unknown.

APPENDIX 5

June 30, 1866.

Designation.	Purchases.	Fabrications.	Total.
Field guns	4,048		4,048
Siege guns	677		677
Sea-coast guns	2,350		2,350
Mortars	817		817
Field carriages and limbers	2,416	1,360	3,776
Siege carriages and limbers	139	651	790
Sea-coast carriages	391	1,863	2,254
Battery wagons, caissons, and forges	3,326	931	4,257
Mortar beds	99	611	710
Projectiles for smooth-bore guns	2,704,852		2,704,852
Projectiles for rifled guns	3,043,610		3,043,610
Pounds of grape and canister shot	6,539,999		6,539,999
Hand grenades	98,200	633	98,833
Rounds of ammunition for smooth bore guns	146,514	1,527,649	1,674,163
Rounds of ammunition for rifled guns	8,543	1,179,471	1,188,014
Carbines, breech-loading	396,896		396,896
Carbines, muzzle-loading	10,838		10,838
Springfield rifle muskets	670,617	801,997	1,472,614
Enfield rifle muskets	428,292		428,292
All other muskets and rifles	795,544		795,544
Revolvers	372,823		372,823
Pistols, muzzle-loading	648		648
Swords	124,676		124,676
Sabres	415,232		415,232
Lances	4,301	266	4,567
Infantry accoutrements, sets of	2,109,175	37,000	2,146,175
Infantry accoutrements, parts of sets	2,259,951	1,168,204	3,428,155
Cavalry accoutrements, sets of	208,371	8,000	216,371
Cavalry accoutrements, parts of sets	1,686,300	123,930	1,810,230
Horse equipments, sets of	478,744	60,800	539,544
Horse equipments, parts of sets	3,491,759	1,049,583	4,541,342
Artillery harness, sets for two horses	18,858	9,306	28,164
Horse blankets	732,526		732,526
Cartridges for carbines	157,658,931	50,617,898	208,276,829
Cartridges for muskets, cal. .577 and .58	46,409,514	424,441,565	470,851,079
Cartridges for all other muskets	8,766,400	221,571,978	230,338,378
Cartridges for pistols	27,068,810	64,385,403	91,454,213
Blank cartridges for small-arms	2,047,011	19,208,964	21,256,975
Cartridge bags, filled		2,205,811	2,205,811
Percussion caps	893,362,574	327,192,861	1,220,555,435
Friction primers		10,281,305	10,281,305
Fuzes		4,226,377	4,226,377
Cannon powder, pounds	9,540,603		9,540,603
Mortar powder, pounds	7,428,142		7,428,142
Musket and rifle powder, pounds	8,834,551		8,834,551
Mealed powder, pounds	358,829		358,829
All other powder, pounds	259,940	17,989	277,929
Nitre, pounds	6,395,152		6,395,152
Sulphur, pounds			
Lead balls, pounds	19,035,884	27,865,019	46,900,903
Lead, pig and wire, pounds	85,481,312	34,080	85,515,392
Cartridge bags, unfilled		4,976,279	4,976,279
Cartridge bag stuff, yards	1,045,618		1,045,618

A. B. DYER,
Brevet Major General, Chief of Ordnance.

ORDNANCE OFFICE, *October* 23, 1866.

ment from January 1, 1861, *to June* 30, 1866.

CLASS 1.—*Field guns.*

587	10-pounder Parrott guns 2.9 and 3-inch	$120,053 67
925	3-inch wrought-iron guns	332,161 42
15	3-inch steel guns	7,612 25
2	3½-inch wrought-iron guns	740 00
2	semi-steel guns	613 65
152	6-pounder bronze guns	61,209 10
162	6-pounder bronze guns, rifled	74,894 47
25	6-pounder Wiard guns	11,109 50
12	6-pounder cast-steel guns	9,633 78
1	9-pounder Sawyer gun	250 00
1,127	12-pounder bronze guns, light and heavy	641,501 79
10	12-pounder bronze guns, rifled	6,893 50
20	12-pounder Wiard guns	14,418 00
2	12-pounder wrought-iron guns	800 00
1	12-pounder "Hooper's metal" gun	3,129 96
388	12-pounder mountain howitzers	52,775 50
73	12-pounder field howitzers	28,038 59
12	12-pounder boat howitzers	5,171 65
6	14-pounder bronze guns	2,553 74
338	20-pounder Parrott guns	133,830 10
10	24-pounder boat howitzers	7,555 40
58	24-pounder field howitzers	24,683 72
63	Union repeating guns	53,485 00
5	Billinghurst & Requa guns	5,482 75
22	Ellsworth guns	9,511 87
30	Woodruff guns	8,550 00

Siege and sea-coast guns.

392	30-pounder Parrott guns	218,401 40
113	4.5-inch rifle guns	51,068 08
1	24-pounder sea-coast gun	750 00
4	24-pounder rifle guns	2,309 63
1	42-pounder sea-coast gun	771 44
1	7-inch rifle gun	700 00
13	7-inch wrought-iron guns, "Ames's"	215,163 96
237	100-pounder Parrott guns	309,093 95
90	200-pounder Parrott guns	201,994 75
40	300-pounder Parrott guns	197,470 50
240	8-inch Rodman guns	194,242 71
1,015	10-inch Rodman guns	1,679,948 55
286	15-inch Rodman guns	1,923,875 41
1	20-inch Rodman gun	32,781 87
3	8-inch rifle guns	7,622 26
16	9-inch Dahlgren guns	11,022 45
1	12-inch rifle gun	6,356 20
1	13-inch Rodman gun	4,500 00
172	8-inch siege howitzers	43,946 36
200	24-pounder flank-defence howitzers	32,870 73
298	24-pound bronze Coehorn mortars	33,068 07
199	8-inch siege mortars	21,828 75
188	10-inch siege mortars	34,180 16
42	10-inch sea-coast mortars	15,765 47
90	13-inch sea-coast mortars	114,632 84

Class 2.

1,551	6-pounder field carriages	$485,160 70
686	12-pounder field carriages	235,967 10
25	12-pounder mountain howitzer carriages	1,696 27
100	12-pounder prairie carriages	17,628 52
54	boat howitzer carriages	27,000 00
2,539	caissons	832,272 33
300	forges "A"	92,295 49
40	forges "B"	12,320 75
241	battery wagons "C"	96,700 06
25	battery wagons "D"	8,394 00
71	4.2-inch gun carriages	30,206 00
6	18-pounder gun carriages	2,280 00
62	8-inch siege howitzer carriages	19,674 36
81	limbers	10,650 00
100	prairie carts	10,958 04
248	100-pounder gun carriages, Parrott's	166,273 00
88	200-pounder gun carriages, Parrott's	69,856 80
32	300-pounder gun carriages, Parrott's	52,976 00
15	carronade carriages	3,375 00
3	8-inch casemate carriages, wood	1,261 65
5	10-inch columbiad carriages, wood	2,197 75
99	mortar beds	45,219 29

Class 3.

11,534	sets artillery harness, two horses, lead	922,459 48
7,324	sets artillery harness, two horses, wheel	689,703 50
22,269	watering buckets	55,441 42
495	pendulum hausses	2,366 20
14,346	artillery paulins	316,648 76
1,935	artillery paulins, made from government canvas	6,875 50
1,241	cannon sights	1,931 25

Class 4.—*Smooth-bore projectiles.*

158,561	6-pounder shot	37,356 46
329,352	12-pounder shot	187,562 78
17,250	18-pounder shot	14,610 36
100,051	24-pounder shot	85,513 23
37,491	32-pounder shot	17,916 56
7,431	42-pounder shot	10,312 78
36,789	8-inch shot	86,067 12
72,533	10-inch shot	310,515 01
150	13-inch shot	1,889 50
1,659	15-inch shot	33,982 22
112	20-inch shot	10,783 89
1,541	6-pound shell	283 70
344,080	12-pound shell	159,610 61
15,719	18-pound shell	12,125 01
211,810	24-pound shell	194,140 48
76,452	32-pound shell	91,290 80
11,190	42-pound shell	18,148 15
140,418	8-inch shell	307,591 17
3,600	9-inch shell	9,528 60
96,617	10-inch shell	421,883 90
578	12-inch shell	[illegible]

22,542	15-inch shell	$350,252 48
50	20-inch shell	3,034 77
145,148	8-inch mortar shell	275,517 75
52,244	10-inch mortar shell	155,835 78
44,181	13-inch mortar shell	304,198 48
110,874	6-pounder spherical case shot	20,163 82
542,743	12-pounder spherical case shot	194,535 59
2,136	18-pounder spherical case shot	1,006 98
58,870	24-pounder spherical case shot	31,969 42
43,794	32-pounder spherical case shot	34,471 75
8,431	42-pounder spherical case shot	8,649 32
7,479	8-inch spherical case shot	11,995 32
6,539,999	pounds grape and canister shot	314,559 61

Projectiles for rifled guns—Absterdam projectiles.

2,480	3-inch shot	3,100 00
24,900	3-inch shell	45,126 60
10,480	3-inch case	25,210 74
230	4.2-inch shot	690 00
6,720	4.2-inch shell	24,778 75
220	4.2-inch case	880 00
15,496	4.5-inch shell	58,661 65
1,232	4.5-inch case	[illegible]
3,601	[illegible] canister	[illegible]

Dyer projectiles:

56,373	3-inch shot	45,415 81
8,398	4.5-inch shot	18,794 31
30	24-pound shot	210 00
284	32-pound shot	1,027 34
66	42-pound shot	288 20
1,615	8-inch shot	9,987 21
281	12-inch shot	10,392 00
1,467	3-inch shell	1,138 28
12,784	4.5-inch shell	27,010 91
329	6-pound shell	664 58
360	24-pound shell	2,313 00
6,007	32-pound shell	24,362 77
17,998	42-pound shell	92,791 70
498	8-inch shell	2,571 14
91	12-inch shell	2,969 88
41,588	3-inch case	28,362 03
8,531	3-inch canister	1,194 34
11,505	3-inch assorted projectiles	7,229 40

Hotchkiss projectiles.

1,795	2.6-inch shot	1,697 00
15,040	3-inch shot	22,203 85
1,600	3.4-inch shot	2,130 28
16,256	3.67-inch shot	22,984 35
1,000	3.8-inch shot	1,750 00
4,788	4.2-inch shot	11,083 60
5,000	4.5-inch shot	17,944 95
761	7-inch shot	8,896 23
12,490	2.6-inch shell	11,085 27

292,244	3-inch shell	314,347 77
6,800	3.4-inch shell	10,391 55
5,721	3 5-inch shell	9,908 90
71,536	3.67-inch shell	116,230 85
7,704	3.8-inch shell	14,672 20
8,372	4.2-inch shell	22,188 50
8,836	4.5-inch shell	32,066 15
2,020	4.62-inch shell	5,830 45
212	7-inch shell	2,550 65
320	2.6-inch case	304 00
296,031	3-inch case	143,466 82
788	3.4-inch case	1,715 80
6,328	3.5-inch case	14,562 15
81,638	3.67-inch case	175,660 10
3,570	3.8-inch case	8,116 20
288	4.2-inch case	1,203 00
1,000	4.5-inch case	2,700 00
2,915	2.6-inch canister	1.830 60
840	2.9-inch canister	771 50
100,372	3-inch canister	103.218 20
1,910	3.4-inch canister	2.131 50
1,340	3.5 inch canister	1.838 15
21,086	3.67-inch canister	[illegible]
636	3.8-inch canister	[illegible]
620	4.2-inch canister	[illegible]

1,610,038.1

Sawyer projectiles.

3,120	6-pound shot	[illegible]
2,440	12-pound shot	[illegible]
35	24-pound shot	[illegible] 75
4,128	6-pound shell	10,073 33
250	9-pound shell	1,000 00
3,052	12-pound shell	10,646 14
238	24-pound shell	1,599 50
4,000	3-inch shell	5,852 00
1.300	6-pound case	3,575 00
100	50-pound case	541 00
3,715	6-pound canister	7,661 9
1,408	12-pound canister	4,022
12	24-pound canister	[illegible]
15	5.82-inch case	[illegible]

61.153c

Parrott projectiles.

149,811	10-pound shot	[illegible]
85,289	20-pound shot	[illegible] 70
80,267	30-pound shot	170.360 70
25,825	100-pound shot	165,717 82
7,331	200-pound shot	92,881 50
1,125	300-pound shot	21,184 66
5,822	24-pound shot	21,636 05
7,957	32-pound shot	39,449 60
5,222	42-pound shot	34,931 20
279,979	10-pound shell	240,019 89
149,449	20-pound shell	216.909 29

1,346,040

199,338	30-pound shell	[illegible]
54,591	100-pound shell	396,657 62
20,229	200-pound shell	259,312 60
4,049	300-pound shell	73,262 34
14,119	24-pound shell	58,743 15
19,035	32-pound shell	92,251 60
7,628	42-pound shell	51,273 80
200	12-inch shell	6,600 00
51,130	10-pound case	106,248 20
26,114	20-pound case	83,094 90
28,860	30-pound case	120,713 90
6,737	100-pound case	56,326 42
2,520	200-pound case	37,436 50
2,086	24-pound case	9,965 05
1,877	32-pound case	10,309 80
22,400	10-pound canister	39,017 40
8,030	20-pound canister	12,566 80
6,080	30-pound canister	11,176 20
4,540	100-pound canister	15,743 12

$3,230,526.62

James's projectiles.

4,793	6-pound shot	8,973 75
3,260	12-pound shot	8,251 50
7,072	24-pound shot	33,418 74
7,342	32-pound shot	43,887 01
9,374	42-pound shot	67,993 40
40	7-inch shot	295 60
100	8-inch shot	1,224 25
10	12-inch shot	313 30
20,828	6-pound shell	45,674 10
6,536	12-pound shell	18,784 50
9,556	24-pound shell	39,208 87
9,350	32-pound shell	53,698 45
1,550	42-pound shell	10,540 00
60	7-inch shell	428 00
3,156	6-pound canister	7,070 20
1,004	12-pound canister	3,097 50
336	24-pound canister	1,528 00

Schenkl projectiles.

1.000	3.67-inch shot	1,330 00
1,310	3.8-inch shot	1,742 30
292	4.2-inch shot	966 00
1,947	4.62-inch shot	4,994 00
57	7-inch shot	555 75
125,510	3-inch shells	275,095 83
35,220	3.67-inch shells	81,540 14
5,556	3.8-inch shell	11,372 00
676	4.2-inch shell	2,430 20
75,118	4.5-inch shell	272,060 96
2,315	4.62-inch shell	7,657 75
367	10-inch shell	5,872 00
53,570	3-inch case	137,136 95
6,500	3.67-inch case	20,118 00
1,630	3.8-inch case	[illegible] 00

292	4.2-inch case	$1,512 40
23,904	4.5-inch case	109,634 00
391	4.62-inch case	1,466 25
600	4.67-inch case	2,250 00
510	3.67-inch canister	1,273 00
500	4.5-inch canister	1,458 75
702	4.67-inch canister	1,401 00
402	4.5-inch shot	971 50

CLASS 5.

25,556	1-pound Ketcham's hand grenades	15,576 80
42,799	3-pound Ketcham's hand grenades	34,340 71
24,845	5-pound Ketcham's hand grenades	22,815 28
5,000	Adams's hand grenades	4,750 00

Fixed ammunition.

33,291	6-pound shot	36,788 35
14,169	6-pound shell	29,864 02
11,026	6-pound case	17,641 60
19,723	6-pound canister	27,423 75
12,333	12-pound shot	20,331 30
31,840	12-pound shell	54,154 10
10,694	12-pound case	20,773 20
12,090	12-pound canister	19,856 90
1,348	32-pound shell	4,044 00
8,543	3-inch canister	10,678 75

CLASS 6.—*Carbines.*

1,509	Ballard	35,140 00
1,002	Ball's	25,387 00
55,567	Burnside	1,412,620 41
9,342	Cosmopolitan	199,838 29
22,728	Gallagher	508,492 94
1,052	Gibbs's	27,995 25
3,520	Hall's	64,763 50
11,261	Joslyn	282,586 00
892	Lindner's	19,895 00
14,495	Merrill's	374,804 63
20,002	Maynard's	489,399 78
1,001	Palmer's	20,918 50
20,000	Remington's	436,752 00
80,512	Sharp's	2,213,192 00
30,062	Smith's	745,645 24
94,196	Spencer's	2,393,633 82
25,603	Starr's	586,773 79
4,001	Warner's	79,310 54
151	Wesson's	3,491 75
200	French carbines	4,800 00
10,051	foreign carbines	66,193 00
587	musketoons	5,815 50

Muskets and rifles.

670,617	Springfield rifle muskets, calibre .58	13,089,855 73
1,000	Lindsay's double shot muskets	25,250 00
35	Ballard rifles	1,262 00
4,612	Colt's revolving rifles	$204,487 00
900	Green's rifles	33,266 43
1,731	Henry's rifles	63,953 26
583	Merrill's rifles	23,880 50
9,141	Sharp's rifles	330,629 97
12,471	Spencer's rifles	467,390 56
1,575	Hall's rifles	23,704 00
22,793	Harper's Ferry rifles	414,316 87
1,832	rifles, calibre .69	20,076 13
428,292	Enfield rifles, long, calibre .577, triangular bayonet	7,869,175 62
8,034	Enfield rifles, short, calibre .577, sword bayonet	187,915 09
162,533	Boker's rifles	2,267,834 82
25,000	Boker's rifles, sword bayonet	139,254 00
44,250	French rifles	757,416 69
57,467	Belgian rifles	811,109 24
226,294	Austrian rifles	2,640,704 41
59,918	Prussian rifles	590,486 82
29,850	Jäger rifles	260,785 74
1,673	Suhl rifles	26,056 50
4,182	Tower rifles	18,819 00
5,995	Garibaldi rifles	35,970 00
81,652	Prussian smooth-bore muskets	554,849 01
29,201	foreign smooth-bore muskets	234,345 94
2,181	American smooth-bore muskets	21,825 00
641	rifles, various kinds	15,256 78

Pistols.

536	Allen's revolvers	9,130 50
415	Adam's revolvers	7,526 38
2,814	Beall's revolvers	38,315 79
129,730	Colt's army revolvers	2,296,112 49
17,010	Colt's navy revolvers	466,068 13
1,100	Joslyn revolvers	24,793 00
200	Perrin's revolvers	4,000 00
2,001	Pettingill's revolvers	40,287 10
12,374	Le Faucheux revolvers	167,489 99
125,314	Remington's army revolvers	1,631,629 61
1,901	Remington's navy revolvers	59,838 40
978	Raphael's revolvers	16,181 73
11,284	Savage's revolvers	221,355 75
17,952	Starr's revolvers	737,793 73
5,000	Roger and Spencer's revolvers	60,739 90
11,214	Whitney revolvers	139,690 39
100	foreign pistols	1,000 00
200	horse pistols	1,400 00
348	signal pistols	1,938 50

Swords and sabres.

189,114	cavalry sabres	1,019,726 99
203,285	light cavalry sabres	1,311,724 70
20,757	horse artillery sabres	107,748 01
797	staff officers' swords	13,992 42
1,279	cavalry officers' sabres	14,845 24
2,038	foot officers' swords	22,531 38
86,655	non-commissioned officers' swords	432,152 61

2,152	foot artillery swords	[illegible]	[illegible]
300	cutlasses	1,359	00
4,301	lances	17,006	00

Class 7.—*Cavalry and artillery equipments.*

72,139	artillery sabre belts	106,263	95
1,500	artillery waist belts	2,087	00
196,351	cavalry accoutrements, full sets	1,268,763	68
238,520	carbine cartridge boxes	283,500	70
236,393	carbine slings	264,467	25
152,331	carbine swivels	98,917	53
325,452	pistol holsters	263,815	84
171,264	pistol cartridge pouches	111,050	83
304,365	sabre belts	516,840	67
225,975	sword knots	65,084	06
12,020	Mann's cavalry accoutrements, sets	98,846	85
32,000	Blakeslee cartridge boxes	153,036	00

Infantry accoutrements.

2,065,875	infantry accoutrements, sets	7,541,643	51
416,290	bayonet scabbards	218,796	00
376,305	cap pouches	171,837	95
190,684	cartridge boxes	213,220	11
114,378	cartridge-box plates	11,357	25
216,358	cartridge-box belts	120,668	18
151,573	cartridge-box belt plates	12,189	95
265,866	gun slings	80,560	71
98,737	non-commissioned officers' sword belts	116,325	79
238,578	waist belts	96,087	46
143,348	waist belt plates	11,738	35
37,000	Mann's infantry accoutrements, sets	199,931	75
9,598	non-commissioned officers' waist belts	5,552	10
20,957	non-commissioned officers' shoulder belts	14,810	30
5,300	Spencer rifle accoutrements, sets	16,986	50
1,000	Blakeslee cartridge-boxes	7,150	00
692	officers' sword belts	1,834	70
11,275	non-commissioned officers' belt plates	2,927	50
3,001	frogs	[illegible]	

Horse equipments.

478,744	horse equipments, full sets	12,610,817	11
80,020	bridles, curb	310,933	13
8,565	bridles, watering	15,341	13
651,863	currycombs	147,563	37
3,986	carbine sockets	1,519	01
60,649	girths	60,034	13
140,360	halters	259,463	77
747,159	horse-brushes	436,254	16
90,777	links	25,836	60
169,614	lariats	71,582	43
339,190	nose bags	481,707	31
258,174	picket pins	36,972	79

[illegible]	[illegible]	[illegible]	
589,588	blankets, blue	1,856,938	50
90,605	blankets, red	368,238	83
45,692	blankets, gray	98,961	93
6,641	blankets, rubber	11,612	75
4,000	felt saddle-cloths	17,370	00
154,914	spurs, pairs	157,526	10
378,088	spur straps, pairs	49,815	59
6,775	stirrups and straps, pairs	2,446	14
69,893	surcingles	93,680	08
3,600	sweat leathers, pairs	5,071	00

Appendages for small-arms.

10,876	ball screws	1,172	45
130,952	cones	9,843	23
93,332	screw-drivers	13,651	83
2,832	spring vices	672	69
4,250	swages	854	00
3,559	tompions	201	03
31,704	wipers	5,059	60

Class 8.

259,910	powder, blasting, pounds	73,017	15
8,897,226	powder, cannon, pounds	2,108,387	41
643,377	powder, mammoth, pounds	215,140	09
7,428,142	powder, mortar, pounds	1,923,675	63
8,557,663	powder, musket, pounds	2,124,283	81
276,888	powder, rifle, pounds	77,791	51
358,829	powder, mealed, &c., pounds	80,207	80
18,205,870	lead bullets, pounds	1,672,926	64
16,920,668	lead bullets, made from government lead	282,018	44
1,120,692	fuzes, time and percussion	449,709	60
40,383	fuzes, combination	26,639	82
222,586	friction primers	4,509	72
830,014	buck-shot, pounds	78,432	93
893,362,574	percussion caps	799,372	05
894,016	fuze plugs	305,394	75
240,611,400	percussion primers, Austrian, &c	11,683	50
2,557,574	Sharp's primers	4,758	74

Cartridges.

3,527,450	Ballard's	57,945	05
21,819,200	Burnside's	547,490	05
6,300,000	Cosmopolitan	132,007	27
8,294,023	Gallagher's	211,893	92
173,760	Green's	3,869	82
1,610,400	Henry's	107,353	05
515,116	Joslyn	12,935	37
100,000	Lindner	2,262	00
2,157,000	Maynard	72,207	50
5,502,750	Merrill's	105,779	32
4,257,000	Remington	68,600	00

16,306,508	Sharp's	$347,410 57
1,001,000	Sharp's & Hankin's	27,402 00
13,861,500	Smith's	377,569 78
58,238,924	Spencer's	1,419,277 16
6,860,000	Starr's	140,768 30
1,028,000	Warner's	27,472 00
46,409,514	rifle, calibre .58, &c	712,913 05
254,000	Wesson's	3,666 60
6,021,220	buck and ball	86,982 28
842,880	Le Faucheux	17,039 00
2,735,180	round ball	51,273 12
2,047,011	blank	10,153 05
2,852,000	carbine	63,227 38
26,225,930	pistol	390,185 86
10,000	Gardner's shell	350 00

CLASS 9.

27,034	saddle-trees	113,459 66
———	spare parts of small-arms	2,605,326 36
22,498	artillery harness irons, sets	191,257 80
20,580	artillery traces, lead	86,509 45
17,020	artillery traces, wheel	47,134 26
43,622	artillery whips	42,535 24
14,367	artillery collars	49,096 33
6,222	artillery halters	9,795 37
22,948	cavalry saddle-trees	101,199 97
3,370	chassis rails	266,912 82
1,610,984	parts of iron gun carriages, pounds	135,262 20
2,020	artillery saddles	42,043 51
33,023	artillery trace chains	47,746 82
1,465,499	buckles	69,251 11
41,171	bits	80,664 66
5,059,400	Maynard's cartridge cases	93,498 02
125,146	blue webbing, yards	51,991 69
266,720	sand bags	11,256 40

Materials, &c.

85,184,312	lead, pounds	7,391,611 [illegible]
348,085	copper, pounds	186,875 57
51,431	zinc, pounds	9,828 29
318,161	rope, pounds	111,316 61
805,350	cartridge paper, pounds	93,050 30
6,395,152	nitre, pounds	743,727 18
14,643	moreens, pieces	92,237 31
576,138	cartridge cloth, yards	139,369 62
103,405	cartridge silk, yards	50,015 01
123,407	cartridge linen, yards	60,021 71
215,387	cotton duck, yards	296,588 [illegible]

A. B. DYER,
Brevet Major General, Chief of Ordnance.

INSTRUCTIONS

FOR MAKING

QUARTERLY RETURNS

OF

ORDNANCE AND ORDNANCE STORES,

AS PRESCRIBED BY THE

GENERAL REGULATIONS OF THE ARMY;

INCLUDING

DIRECTIONS RESPECTING THE EVIDENCE REQUIRED IN SETTLING THE ORDNANCE PROPERTY ACCOUNTS OF OFFICERS LEAVING THE SERVICE;

PREPARED AT

THE ORDNANCE BUREAU

UNDER THE DIRECTION OF

THE CHIEF OF ORDNANCE.

WASHINGTON:
GOVERNMENT PRINTING OFFICE.
1865.

PRICE LIST OF ORDNANCE STORES.

ACCOUTREMENTS.

Artillery.

Sabre belts and plates	$1 59

Cavalry.

Complete sets	$7 90	Carbine slings, buff leather, blocked	$1 52
Complete sets, Mann's patent	9 45	Carbine slings, grained leather, blocked	1 36
Cartridge boxes for Smith's carbine	1 30	Carbine swivels	50
Cartridge boxes for Merrill's carbine	1 44	Pistol holsters	90
Cartridge boxes and belts, Mann's patent	3 65	Pistol cartridge pouches	60
Cartridge boxes and belts for Sharps' carbine	1 30	Sabre belts and plates, buff leather, blacked	2 15
Cartridge boxes and belts for Warner's carbine	1 38	Sabre belts and plates, grained leather, blacked	1 90
Cartridge boxes, Blakeslee's patent	4 85	Sabre belts and plates, Mann's patent	2 05
Cartridge boxes, Regulation patent	1 43	Sword knots	32

Infantry.

Complete sets infantry accoutrements	$5 40	Cartridge boxes	$1 15
Complete sets infantry accoutrements, Mann's patent, 40 rounds	5 30	Cartridge boxes and belts, Mann's patent	3 65
Complete sets infantry accoutrements, Mann's patent, 60 rounds	5 30	Cartridge-box plates	13
Bayonet scabbards, leather	40	Cartridge-box belts	59
Bayonet scabbards, leather, S. B.	92	Cartridge-box belt plates	09
Bayonet scabbards, leather, Hoffman's attachment	85	Gun slings	34
Cap pouches and picks	60	Waist belts, buff	42
		Waist belts, grained	36
		Waist-belt plates	06
		Waist belt and catch, Mann's patent	85

HORSE EQUIPMENTS.

Curb bridle	$5 00	Picket pins	$0 15
Watering bridle	1 05	Saddles, complete	18 15
Currycomb	30	Saddle bags	4 75
Carbine socket and strap	50	Saddle blankets, blue	4 25
Crupper	1 20	Saddle blankets, red	4 25
Girth	1 07	Saddle cloths, patent, felt	4 50
Halter and strap	2 40	Spurs, pairs	40
Horse brushes	1 00	Spur straps, pairs	15
Link	32	Stirrup leathers, pairs	1 70
Lariat	1 00	Stirrups and hoods, wooden	1 45
Nose-bag	2 00	Surcingles	1 50

CARTRIDGES FOR SMALL ARMS.

For Carbines.

Ballard's carbine (per M)	$17 00	Sharps & Hankin's carbine (per M)	$27 00
Burnside's carbine do.	31 00	Smith's carbine do.	26 50
Cosmopolitan carbine do.	24	Spencer's carbine do.	35 00
Gallagher's carbine do.	24 00	Starr's carbine do.	24 75
Henty's carbine do.	24 00	Warner's carbine do.	26 00
Merrill's carbine do.	19 00		

Pistol Cartridges.

Colt's, Remington's, and Starr's, paper, cal. .44	$18 50	Colt's, Remington's, and Starr's, skin, cal. .38	$13 00
Colt's, Remington's, and Starr's, paper, cal. .36	16 50	Lefaucheaux, metallic	25 00
Colt's, Remington's, and Starr's, skin, cal. .44	15 00	Round, for S. B. pistols	10 00

Percussion caps, regulation, (per M)	$1 26	Percussion caps, for pistols, (per M)	$1 26

PARTS OF SMALL ARMS.

Parts of Remington's Pistols.

Barrel	$2 35	Lever plunger	$0 14
Barrel stud	08	Lever link	08
Barrel sight	08	Lever catch	08
Bolt	36	Lever-catch spring	05
Centre pin	14	Main spring	30
Centre-pin spring	05	Pawl	22
Cones (7)	70	Pawl spring	02
Cylinder	2 63	Sear spring	08
Frame	4 25	Screws, (8)	20
Guard	65	Stock	45
Hammer	65	Screw-driver	20
Hammer roll	06	Trigger	30
Hammer cam	06		
Lever	1 00	Total	15 50

Parts of Burnside's Carbine.

Band	$0 20	Link-joint screw	$0 05
Band springs	08	Lock plate	40
Barrel	3 12	Main spring	30
Breech piece	2 25	Main-spring screws	04
Breech pin	70	Rear-sight base	20
Breech-pin bolt	03	Rear-sight base screw	04
Breech-pin bolt spring	01	Rear-sight leaf	20
Breech-pin bolt spring screw	03	Rear sight leaf-joint pin	01
Bridle	19	Ring	08
Bridle screws (2)	04	Ring bar	16
Butt plate	40	Ring-bar screw	03
Butt plate wood screws (2)	04	Sear	18
Chamber	1 90	Sear screw	04
Chamber bushing	08	Side screw, front	04
Chamber-bushing screws (2)	03	Side screw, rear	04
Chamber-guide screws	04	Stock butt	1 50
Cone	04	Stock-butt escutcheon	06
Front sight	08	Stock tip	40
Guard bow	1 12	Stock-tip escutcheon	06
Guard-bow screw (front)	04	Stock-tip escutcheon screw	04
Guard-bow screw (rear)	04	Stock tip escutcheon-screw stud	06
Hammer	30	Swivel base	12
Hook	17	Swivel-base wood screws	04
Latch	64	Swivel stud	04
Latch-joint screw	05	Swivel washer	03
Latch spring	06	Swivel-strap loop	09
Latch-spring screw	03	Swivel-strap loop rivet	02
Lever key	17	Tang screw, front	04
Lever-key stop pin	21	Tang screw, rear	04
Lever key stop-pin spring	01	Tap strap	20
Lever key stop-pin spring screw	03	Tap-strap breech screw	04
Link (front joint of guard)	75	Trigger	15

Trigger strap	$0 30		
Trigger-strap wood screw	04		
Trigger spring	06		
Trigger-spring screw	03		
Trigger pin	01		
Tumbler	28		
Tumbler screw	03		
Tumbler stirrup	07		
Tumbler-stirrup pin	01		

Appendages.

Cone, extra	$0 04
Cone wrench and screw-driver	26
Thong brush	20
Tompion	01
Total	19 00

Parts of Maynard's Carbine.

Barrel	$8 00	Side plate	$0 35
Barrel-axis screw	05	Stirrup	20
Butt plate	56	Stirrup attaching pin	01
Butt-plate screw, long	05	Stock butt	1 25
Butt-plate screw, short	04	Swivel bar	35
Breech piece	6 00	Swivel-bar ring	15
Cone	10	Swivel-bar screw	04
Guard plate	55	Rear-sight base	54
Guard-plate screw	08	Rear sight, first leaf	30
Guard-plate wood screw	04	Rear sight, second leaf	36
Front sight	25	Rear-sight leaf axis screw	04
Hammer and tumbler	1 20	Trigger and sear	40
Hammer screw	05	Trigger screw	05
Lever and guard	1 25	Tang screw	07
Lever-catch pin	03	*Appendages.*	
Lever link	30	Cone, extra	10
Lever-link screw	08	Cone wrench and screwdriver	30
Lever-axis screw	05	Brush wiper and thong	30
Main spring	45		
Main-spring screw	06	Total	24 20
Sear spring	20		

Parts of Merrill's Carbines.

Band	$0 15	Lock screw	$0 20
Band spring	10	Lock plate	20
Barrel	3 50	Main spring	55
Breech	2 25	Plunger	1 00
Bridle	20	Rear sight	90
Butt plate	60	Stock	3 00
Cone	15	Side plate and ring	44
Guard trigger and sear	90	Sear	20
Hammer	60	Sear spring	16
Lever	1 75	Tumbler	25
Lever catch	20		
Lever-catch spring	10	Total	18 00
Link	60		

Parts of Sharps' Carbine.

Barrel	$4 00	Guard strap (S. F.)	$0 85
Barrel stud	20	Guard-strap screws, front	04
Barrel bouching	25	Guard-strap screws, rear	04
Band	40	Hammer	90
Band spring	08	Lever	75
Bridle	25	Lever screw	04
Bridle screws	08	Lever spring	12
Butt plate	90	Lever-spring screw	04
Butt-plate screws	08	Lever key	35
Cone	10	Lever-key stop	04
Front-sight screw	04	Lever-key stop spring	04
Front-tang screw	04	Lever-key stop spring screw	04
Front-sight stud	03	Lever catch	20
Front-sight pin	01	Lever-catch screw	04
Front sight, silver	02	Lever-catch spring	08

Lever-catch spring screw	$0 04
Lever-catch spring pin	04
Lock plate	1 60
Main spring	50
Main-spring screw	04
Primer spring	06
Primer-spring screw	04
Primer follower	04
Primer-follower pin	02
Primer driver	20
Primer slide	12
Primer covers	08
Primer-cover screw	04
Primer-cover pin	02
Primer-cover shut-off	20
Primer-cover shut-off screw	04
Rear-sight base springs	25
Rear sight base-spring screw	04
Rear-sight base pin	02
Rear-sight elevator	35
Rear-sight chair	20
Rear-sight slide	12
Rear-sight slide screw	04
Rear-sight screw	04
Rear tang screw	04
Receivers	2 50
Slide	1 50
Slide screw	04
Slide gas plate	$0 50
Slide-vent tube	08
Slide-vent tube screw	04
Sear	25
Sear screw	04
Stock butt	1 75
Stock-butt escutcheon	04
Stock tips	65
Stock-tip screw	04
Stock-tip escutcheon	04
Swivel bar	35
Swivel-bar screw	04
Swivel-bar ring	07
Toggle	15
Toggle screw	04
Trigger	25
Trigger screw	04
Tumbler	50
Tumbler screw	04
Tumbler stirrup	06
Tumbler-stirrup screw	04

Appendages.

Cone wrench and screw-driver	35
Brushes	25
Thong	12
Total	24 00

Spencer's Carbine.

Barrel and sights	$7 00
Barrel stud	07
Barrel screw	03
Breech pin	50
Bridle	25
Bridle screws (2)	06
Butt plate	60
Butt-plate screws	08
Butt stock	1 00
Breech-pin spring	05
Band	19
Band spring	16
Carrier block	1 05
Carrier-block screw	04
Cartridge follower	12
Cartridge-follower screw	03
Cartridge guide	19
Cartridge-guide screw	03
Cartridge-guide spring	08
Cartridge-guide spring	01
Cartridge stock	04
Cartridge-stock pin	02
Escutcheon	03
Guard lever	07
Guard-lever screw	03
Hammer	73
Lock plate	40
Lock-plate screw	03
Magazine nut	05
Magazine lock	42
Magazine-lock spring	05
Magazine-lock spring screw	03
Magazine-lock spring pin	02
Magazine-lock catch	05
Magazine-lock catch screw	$0 03
Magazine outer tube	47
Magazine inner tube	40
Magazine spring	09
Main spring	60
Main-spring screw	03
Percussion slide	14
Percussion-slide screw	03
Receiver	4 00
Sear	30
Sear screw	03
Stirrup	11
Stirrup screw	03
Sight leaf	30
Sight-leaf screw	03
Sight slide	12
Sight base	22
Sight-base screw	03
Sight spring	10
Slide screw	05
Shell drawer	04
Shell-drawer screw	03
Swivel	17
Swivel screw	03
Swivel base	19
Swivel-base screws (2)	08
Swivel bar	15
Swivel-bar plate	34
Swivel-bar ring	15
Swivel-plate screw	03
Tips, stock	67
Trigger	17
Trigger screw	03
Trigger plate	34

Trigger-plate screw	$0 03
Trigger-plate screw, wood	08
Tumbler	53
Tumbler screw	04

Appendages.

Brush and thong	$0 40
Screw-driver	15
Total	25 00

Smith's Carbine.

Barrel	$6 00
Breech piece	3 75
Barrel receiver	1 65
Barrel-receiver axis screw	05
Butt plate	58
Butt-plate screw	05
Breech bolt	22
Bar and swivel for barrel	70
Bar and swivel for stock	46
Barrel-band screw	05
Cone	10
Clasp or joint spring	75
Clasp-spring screw	05
Clasp-spring lifter	22
Clasp-spring lifter screw	05
Escutcheon	10
Escutcheon screw	05
Front sight	32
Guard bow	88
Guard-bow breech screw	05
Guard-bow wood screw	05
Guard-bow stud	08
Hammer	80
Main spring	50
Main-spring screw	$0 05
Rear sights, complete	1 50
Sight blade	62
Sight-blade screw	05
Stock band	62
Stock butt	1 38
Stock tip	59
Sear spring	31
Sear-spring axis pin	05
Stirrup	22
Swivel-bar screw (2)	10
Tumbler	75
Tumbler screw	05
Trigger	44
Trigger screw	05
Vent screw	05

Appendages.

Brush wiper	25
Bullet mould	10
Cone, extra	10
Cone wrench and screw-driver	30
Total	25 00

Starr's Carbine.

Barrel	$4 00
Breech plate	1 50
Butt plate	55
Band	29
Band spring	10
Bridle	43
Back-sight base	35
Back-sight leaf	25
Cone	08
Cone driver	50
Escutcheon	06
Fore arm	75
Guard lever	1 00
Guard-lever pin	03
Guard-lever cover	10
Guard-lever cover rivet	01
Guard-lever catch	07
Guard-lever catch spring	02
Guard-lever catch pin	01
Guard-lever spring	10
Guard-lever spring pin	02
Hammer	$1 50
Lock plate	60
Main spring	75
Ring	15
Receiver	2 50
Sear	50
Sight front	15
Sight pin	01
Stirrup	09
Stirrup pin	01
Staple	05
Stock	2 80
Small screws	56
Trigger	40
Trigger plate	60
Trigger-plate pin	01
Tumbler	60
Wedge	1 00
Total	23 50

Parts of Warner's Carbine.

Barrel	$6 50
Band	30
Band spring	10
Breech block	65
Breech-block joint screw	02
Breech-block catch	$0 25
Breech-block catch screw	02
Breech-block catch spring	02
Breech-block plunger	25
Breech-block plunger screw	02

Butt plate	$0 30
Butt-plate screws (2)	04
Cartridge extractor	50
Cartridge-extractor spring	05
Front sight	25
Guard	50
Guard screws (2)	04
Hammer and tumbler (in one piece)	70
Hammer and tumbler screw	02
Lock frame	5 00
Lock-frame tang screw	02
Lock-frame cap	25
Lock-frame cap screw	02
Main spring	25
Main-spring screw	02
Rear-sight base	35
Rear-sight base screw	04
Rear-sight leaf	$0 20
Rear-sight leaf joint screw	02
Sear and trigger (in one piece)	30
Sear and trigger screw	02
Sear and trigger spring	10
Sear and trigger-spring screw	02
Stirrup	10
Stirrup rivet	01
Sling ring	12
Sling-ring bolts	20
Sling-ring bolt nut	08
Stock	1 60
Stock tip	15
Stock-tip screw	02
Stock-tip washer	02
Total	19 44

Parts of Remington's Carbine.

Band	$0 24
Band spring	16
Barrel and front sight	6 50
Breech piece	1 04
Butt plate	50
Butt-plate screws (2)	08
Breech-piece pin	05
Escutcheon	04
Escutcheon screw	04
Guard, complete	1 24
Hammer	1 04
Hammer pin	05
Main spring	50
Main-spring screws	04
Rear sight	78
Rear-sight screw	03
Rear-sight pin	03
Receiver	4 20
Screws for pins (2)	$0 08
Sear springs	24
Sear-spring screw	04
Side screws (5)	18
Stirrup	12
Stirrup pin	03
Stock butt	80
Stock tip	60
Swivel bar and ring (2)	22
Swivel-bar and ring screw	04
Tang	36
Tang screw	04
Trigger	24
Trigger pin	02
Wood screw for stock	04
Appendages	40
Total	20 00

Parts of Springfield Rifle Musket, model 1864, calibre .58.

Barrel	$3 81
Bayonet	1 26
Bayonet clasp	14
Bayonet-clasp screw	01
Bayonet clasp stop screw	01
Breech screw	22
Bridle	13
Bridle screw	01
Butt plate	36
Butt-plate screws (2)	08
Band, lower	14
Band, middle	20
Band, upper	14
Band springs (3)	15
Band swivel	08
Cone	07
Front sight	03
Guard screws (2)	06
Guard plate	31
Guard bow	21
Guard-bow swivel	08
Guard-bow nuts (2)	06
Guard bow screws (2)	03
Hammer	33
Lock plate	46
Main spring	25
Main-spring swivel rivet	$0 01
Ramrod	62
Ramrod stop	02
Ramrod spring	04
Ramrod-spring pin	01
Rear-sight base	20
Rear-sight base screw	02
Rear-sight leaf	12
Rear-sight joint screw	01
Stock	1 23
Sear	12
Sear screw	01
Sear spring	10
Sear-spring screw	01
Side screws (2)	08
Side-screw washers (2)	06
Tang screw	03
Tumbler	30
Tumbler screw	02
Tip stock	10
Tip screw	01
Trigger	10
Trigger screw	01
Vent screw	03
Total	11 94

Parts of U. S. Rifle Musket, calibre .69.

Barrel	$4 67
Bayonet	1 47
Bayonet clasp	16
Bayonet-clasp screw	02
Breech screw	10
Bridle	16
Bridle screw	03
Butt plate	30
Butt-plate screws (2)	08
Cone	.009
Front sight	01
Guard plate	42
Guard bow	30
Guard-bow nuts (2)	04
Guard-bow swivel	10
Guard screws	08
Band, lower	15
Band, middle	18
Band, upper	28
Band springs (3)	30
Band swivel	12
Hammer	60
Lock plate	50
Main spring	$0 27
Ramrod	50
Ramrod spring	12
Ramrod stop	01
Rear-sight base	38
Rear-sight base screw	05
Rear sight, first leaf	22
Rear sight, joint leaf	03
Rear sight, second leaf	25
Stock	1 45
Side plate	07
Side screws (2)	14
Sear	20
Sear screw	03
Sear spring	10
Sear-spring screw	03
Tang screw	05
Tumbler	27
Tumbler screw	03
Trigger	12
Trigger screw	02
Total	14 50

Parts of Harper's Ferry Rifle.

Barrel	$4 50
Butt plate	40
Butt-plate screw	04
Base screw	02
Breech screw	25
Bridle	17
Bridle screw	02
Cone	06
Guard bow and swivel	40
Guard-bow nuts	03
Guard screws	04
Guard plates	40
Hammer	40
Lock plate	37
Lower bands	26
Lower-band springs	10
Main spring	43
Main-spring swivel	08
Main-spring swivel rivets	.005
Patch-box hinge	40
Patch-box spring	07
Patch-box spring screw	.025
Patch-box screw	06
Patch-box catch	04
Ramrod	65
Ramrod spring	10
Ramrod-spring pin	.015
Ramrod stop	.015
Rear sight	50
Sabre-bayonet hilt	$1 20
Sabre-bayonet blade	1 50
Sabre-bayonet scabbard	65
Sear	16
Sear screw	02
Sear spring	20
Sear-spring screw	.015
Side screws	.085
Side-screw washers	08
Stock	1 25
Tang screw	05
Tip	13
Tip screw	01
Trigger	15
Trigger screw	01
Tumbler	30
Tumbler screw	03
Upper band and swivel	32
Upper-band spring	10
Appendages.	
Screw-driver and cone wrench	18
Tompion	08
Wiper	08
Tumbler punch	12
Ball screw	08
Spring vise	30
Total	17 00

Swords and Sabres.

Sabres, light cavalry	$6 50
Swords, non-commissioned officers'	4 50
Swords, musicians'	$4 00

CLASS VI.—SMALL ARMS.

Carbines.

BREECH LOADING.

Ballard's breech-loading, rifled, O. M				Cal. bore .54,	Cham. .56
Ballard's	do.	do.	model 1864	do. .42,	do. .44
Ball's	do.	do.	do. (repeating 10 shots)	do. .41,	do. .44
Burnside's	do.	do.	model 1863	do. .54,	do. .56
Calisher & Terry's breech-loading, rifled.					
Cosmopolitan	do.	do.	old and new model	do. .50,	do. .625
Gallagher's	do.	do.		do. .51,	do. .56
Gibbs'	do.	do.		do. .52,	do. .58
Greene's	do.	do.	{ oval bore, maj. axis, .546 / minor axis, .53 }	do. .546,	do. .555
Hall's	do.	do.		do. .645,	do. .675
Henry's	do.	do.	(repeating 12 shots)	do. .44,	do. .46
Johnson's	do.	do.		do. .44,	do. .46
Joslyn's	do.	do.	model 1863	do. .54,	do. .56
Lindner's	do.	do.	old and new models	do. .57,	do. .60
Merrill's	do.	do.	old and new models	do. .54,	do. .56
Mount Storm	do.	do.			
Maynard's	do.	do.	model 1863	do. .50,	do. .55
North's	do.	do.		do. .44.	
Palmer's	do.	do.		do. .41,	do. .44
Remington's	do.	do.	model 1864	do. .42,	do. .44
Schrœder's	do.	do.			
Sharps'	do.	do.		do. .52,	do. .59
Sharps & Hankin's	do.	do.		do. .52	do. .56
Smith's	do.	do.	model 1857	do. .50,	do. .66
Smith's	do.	do.	model 1864	do. .50,	do. .57
Spencer's	do.	do.		do. .52,	do. .564
Starr's	do.	do.	O. M., (linen cartridge)	do. .54,	do. .60
Starr's	do.	do.	N. M., (copper cartridge)	do. .52,	do. .57
Symm's	do.	do.			
Warner's	do.	do.	model 1863	do. .50,	do. .52
Wood's	do.	do.			

MUZZLE LOADING.

Rifled carbines, Austrian	Calibre bore .71
Rifled carbines, English artillery	do. .54
Rifled carbines, English sappers, "Enfield model"	do. .577
Rifled carbines, French	do. .60
Rifled pistol carbines	do. .58
Rifled musketoons, U. S. model, artillery, cavalry, sappers	do. .69
Smooth-bore musketoons, English	do. .64
Smooth-bore musketoons, U. S. model	do. .69
Minié carbines, No. 2.	
Minié carbines, No. 5	

Muskets and Rifles.

FIRST CLASS.

(American Manufacture.)

(1) Rifled muskets, "Springfield," models 1855, 1861, and 1863	Calibre bore .58
Rifled muskets, "Springfield," cadet model	do. .58
Rifled muskets, "Enfield model," sword bayonet	do. .58
Rifled muskets, Lindsay's pattern	do. .58
Rifled muskets, primer lock	do. .58
Rifles, Ballard's breech-loading	Cal. bore .44, Cham. .46
Rifles, Ballard's do.	do. .54, do. .56
Rifles, Colt's revolving, (repeating 5 shots,) triangular bayonet	do. .56, do. .57
Rifles, Colt's sporting, (repeating 5 shots,)	do. .44, do. .45
Rifles, Greene's breech-loading, triangular bayonet	do. .546, do. .555
Rifles, Henry's do. (repeating 12 shots)	do. .42, do. .44
Rifles, Merrill's do.	do. .54, do. .56
Rifles, Sharps' do. triangular bayonet	do. .52, do. .59
Rifles, Spencer's do. do.	do. .52, do. .564
(2) Rifles, U. S., sword bayonet, model 1840 and 1855	Calibre bore .58
(2) Rifles, U. S., triangular bayonet, model 1840 and 1855	do. .58
(2) Rifles, U. S., sword bayonet, model 1840	do. .54
(2) Rifles, U. S., model 1840, without bayonet	do. .54

(Foreign Manufacture.)

Rifled muskets, Enfield, interchangeable	Calibre .577
Rifled muskets, Enfield	do. .577
Rifled muskets, Dresden, triangular bayonet	do. .58
Rifled muskets, short Dresden, triangular bayonet	do. .58
Rifled muskets, French, triangular bayonet	do. .58
Rifled muskets, Springfield model, *German*	do. .58
Rifled muskets, "Suhl," brass, or bright-mounted	do. .58
Rifles, Enfield, sabre bayonet	do. .577
Rifles, Liège, sabre bayonet	do. .577
Rifles, light French, sabre bayonet	do. .577

SECOND CLASS.

(American Manufacture.)

Rifled muskets, altered to percussion	Calibre .69
Rifled muskets, model 1842, (include Remington's and Justice's make,)	do. .69
Rifled muskets, primer lock	do. .69
Rifled muskets, Enfield model, sword bayonet, leather scabbards	do. .59

(Foreign Manufacture.)

Rifled muskets, Austrian, Boker's, No. 13, quadrangular bayonet	Calibre .71
Rifled muskets, Austrian, Boker's, 9 or 9½, triangular bayonet	do. .701
Rifled muskets, French, triangular bayonet	do. .71
Rifled muskets, Belgian, do.	do. .71
Rifled muskets, Belgian, do.	do. .69
Rifled muskets, French, brass-mounted, triangular bayonet	do. .69
Rifled muskets, French, bright-mounted, do.	do. .69

(1) State which model, according to year of fabrication.
(2) These four include what are known as "Harper's Ferry," "Mississippi Jagers," "Remington," "Windsor," and "Justice Rifles."

Rifled muskets, Prussian, triangular bayonet .... Calibre .615
Rifled muskets, Austrian, leaf sight, quadrangular bayonet .... do. .59
Rifled muskets, Austrian, do. do. .... do. .58
Rifled muskets, Austrian, block sight, do. .... do. .58
Rifled muskets, Austrian, leaf sight, do. .... do. .577
Rifled muskets, Austrian, block sight, do. .... do. .577
Rifled muskets, Austrian, quadrangular bayonet .... do. .55
Rifled muskets, Austrian, do. .... do. .54
Rifles, Belgian or Vincennes, sabre or sword bayonet .... do. .71
Rifles, Austrian, sabre or sword bayonet .... do. .625
Rifles, short, "Jager's," sabre or sword bayonet .... do. .54

THIRD CLASS.

American Manufacture.

Rifles, percussion, sporting, various calibres.
Smooth-bore muskets, altered to percussion, patent breech .... Calibre .69
Smooth-bore muskets, model 1842 .... do. .69
Smooth-bore muskets, primer lock .... do. .69
Smooth-bore shot guns.

Foreign Manufacture.

Rifled muskets, Austrian .... Calibre .72
Rifled muskets, Austrian, shot, quadrangular bayonet .... do. .71
Rifled muskets, Austrian, Boker's, No. 1 .... do. .71
Rifled muskets, Austrian, do. Nos. 6 and 7 .... do. .71
Rifled muskets, Austrian, do. Nos. 11, 11½, or 12 .... do. .71
Rifled muskets, Austrian, iron or brass-mounted .... do. .71
Rifled muskets, English "Tower" .... do. .71
Rifled muskets, Saxony .... do. .71
Rifled muskets, Prussian .... do. .71
Rifled muskets, Prussian, brass or iron-mounted .... Calibre .69 or .70
Rifled muskets, Austrian, brass or iron-mounted .... Calibre .69
Rifled muskets, Bavarian .... do. .69
Rifles, Liège, sword bayonet .... do. .71
Smooth-bore muskets, Austrian, triangular bayonet .... Calibre .71 and .72
Smooth-bore muskets, Austrian, triangular bayonet .... do. .69 and .70
Smooth-bore muskets, Prussian, triangular bayonet .... do. .70 and .71
Smooth-bore muskets, Prussian, triangular bayonet .... Calibre .69
Smooth-bore muskets, French, triangular bayonet .... do. .70
Smooth-bore muskets, French, triangular bayonet .... do. .69
Smooth-bore muskets, English, triangular bayonet .... Calibre .69 and .70

FOURTH CLASS.

American Manufacture.

Rifles, Hall's flint-lock .... Calibre .52
Rifles, Hall's percussion .... do. .52
Rifles, U.S., flint-lock .... do. .54
Smooth-bore muskets, flint-lock, model 1822 .... do. .69
Blunderbusses.
Wall pieces.

Foreign Manufacture.

Rifles á tige, French, sabre bayonet .... Calibre .63
Rifles á tige, French .... do. .58
Rifles, Garibaldi, sword bayonet, no scabbards .... Calibre .69 and .71
Rifles, French, Boker's Vincennes, sword bayonet, steel scabbards .... Calibre .69
Smooth-bore muskets, Austrian .... Calibre .73, .74, and .79
Smooth-bore muskets, English "Tower" .... Calibre .72 to .75
Blunderbusses.
Escopetts, flint-lock.
Escopetts, altered to percussion.
Wall pieces.

Pistols.

* REVOLVERS.

Adams' army .... Cal. bore .44, Cham. .45
Allen's army .... do. .44, do. .45
Beal's army.
Beaumont's army.
Colt's army, old and new models .... do. .44, do. .45
Colt's navy, do. do. .... do. .37, do. .376
Colt's pocket, do. do. .... do. .31.
Godillot's.
Hoard's army .... do. .44, do. .455
Joslyn's army .... do. .44, do. .45
Perrin's.
Pettingill's army .... do. .435.
Lefaucheux, army .... do. .4275, do. .4715
Lefaucheux, navy .... do. .35, do. .40
Remington's army .... do. .44, do. .45
Remington's navy .... do. .36, do. .37
Savage's army and navy .... do. .3625, do. .383
Starr's army .... do. .44, do. .45
Whitney's army, Colt's pattern .... do. .44, do. .45
Whitney's navy, Colt's pattern .... do. .36, do. .37

SINGLE-BARREL.

Pistols, rifled, model 1855 .... Calibre .58
Pistols, smooth-bore, model 1822, 1840 .... do. .54
Pistols, smooth-bore, Derringer .... do. .54
Pistols, signal.

Sabres, Swords, Lances, &c.

Sabres, cavalry, American manufacture.
Sabres, cavalry, foreign manufacture.
Sabres, light cavalry, American manufacture.
Sabres, light cavalry, foreign manufacture.
Sabres, cavalry officers', American manufacture.
Sabres, cavalry officers', foreign manufacture.
Sabres, staff and field officers', American manufacture.
Sabres, staff and field officers', foreign manufacture.
Sabres, horse artillery, American manufacture.
Sabres, horse artillery, foreign manufacture.

* In specifying revolvers on the return, never use the expressions "belt" or "holster" revolvers. They are very indefinite. The name of the patentee and the calibre should always be stated.

SWORDS.

Swords, foot artillery, American manufacture.
Swords, foot artillery, foreign manufacture.
Swords, foot officers', American manufacture.
Swords, foot officers', foreign manufacture.
Swords, musicians', leather scabbards, American manufacture.
Swords, musicians', leather scabbards, foreign manufacture.
Swords, musicians', steel scabbards, American manufacture.
Swords, musicians', steel scabbards, foreign manufacture.
Swords, N. C. O., leather scabbards, American manufacture.
Swords, N. C. O., leather scabbards, foreign manufacture.
Swords, N. C. O., steel scabbards, American manufacture.
Swords. N. C. O., steel scabbards, foreign manufacture.
Swords, staff, pattern 1861, American manufacture.
Swords, staff, foreign manufacture.
Swords, cadet.
Swords, Lafayette.
Sword bayonets.
Cutlasses, American manufacture.
Cutlasses, foreign manufacture.

LANCES, PIKES, &c.

Lances, American manufacture.
Lances, foreign manufacture.
Lances, American, with pennons and straps.
Knives, riflemen
Pikes.

CLASS 7.—ACCOUTREMENTS AND APPENDAGES FOR SMALL ARMS, AND HORSE EPUIPMENTS FOR ARTILLERY AND CAVALRY.

Accoutrements.

FOR ARTILLERY.

Sabre belts and plates.
Waist belts and plates, (foot artillery.)
Waist belts and new pattern plates, (foot artillery.)

FOR CAVALRY.

Carbine cartridge boxes, new pattern, calibre .60.
Carbine cartridge boxes, old pattern, calibre .60.
Carbine cartridge boxes, Blakeslee patent.
Carbine cartridge boxes, for Burnside's, calibre .56.
Carbine cartridge boxes, for Merrill's, calibre .56.
Carbine cartridge boxes, for Sharp's, calibre .59.
Carbine cartridge boxes, for Smith's, O. M., calibre .66.
Carbine cartridge boxes, for Spencer's, calibre .57.
Carbine cartridge boxes, for Warner's, calibre .515.
Carbine cartridge-box plates.
Carbine slings, buff leather, black.
Carbine slings, grained or waxed, leather, black.
Carbine sling swivels.
Covers for carbines.
Pistol belt holsters, for Colt's, Remington's, and Starr's pistols.
Pistol belt holsters, for Savage's pistols.
Pistol belt holsters, for Adams', Perrin's, and Lefaucheux's.
Pistol belt-holster covers.
Pistol cartridge pouches.
Pistol cartridge-pouch plates.
Sabre belts.
Sabre-belt plates.
Sword knots.

FOR INFANTRY.

Ball pouches.
Bayonet scabbard's, leather.
Bayonet scabbards, leather, for Austrian quadrangular bayonet.
Bayonet scabbards, steel.
Bayonet scabbards, leather, sword bayonets.
Bayonet scabbards, steel, sword bayonets.
Cap pouches and picks.
Cartridge boxes, elongated ball, cal. .58.
Cartridge boxes, elongated ball, cal. .69.
Cartridge boxes, round ball, cal. .69.
Cartridge boxes, Merrill's rifle, cal. .56.
Cartridge boxes, Sharp's rifle, cal. .59.
Cartridge boxes and shoulder belts, Mann's patent.
Cartridge boxes, old model, wood.
Cartridge-box plates.
Cartridge-box belts, buff leather, black.
Cartridge-box belts, grained leather.
Cartridge-box belts, waxed leather.
Cartridge-box belt plates.
Covers for muskets.
Flasks, copper, powder.
Frogs, for sword bayonets.
Gun slings.
Scabbards for rifle knives.
Sword belts, non-commissioned officers', and musicians' and sappers'.
Sword-belt plates, non-commissioned officers' and musicians'.
Sword-belt plates, sappers'.
Waist belt, buff leather, black.
Waist belts, grained leather.
Waist belts, waxed leather.
Waist belts, waxed, sliding frogs.
Waist belts, Mann's patent.
Waist belts, N. C. officers'.
Waist-belt plates, N. C. officers'.
Waist-belt plates.
Waist-belt plates, new pattern.

*Appendages.

BURNSIDE'S CARBINES.

Bullet moulds.
Cones, spare.
Screw-drivers.
Wiping rods.

GALLAGHER'S CARBINE.

Bullet moulds.
Cones, spare.
Screw-drivers and cone wrenches.

HALL'S CARBINES.

Bullet moulds.
Cones, spare.
Spring vises.
Wipers.

SHARPS' CARBINES.

Bullet moulds, casting one ball
Bullet moulds, casting six balls.
Cones, spare.
Gas cheek rings, spare.
Primer springs, spare.
Screw-drivers and cone wrenches.
Wipers, with thong and rod.

SPRINGFIELD RIFLED MUSKETS—MODELS '55 AND '61.

Ball screws.
Bullet moulds, ex. ball, calibre .58.
Cones, spare.
Compound appendages.
Screw-drivers and cone wrenches.
Spring vises.
Swedges.
Tompions.
Tompions, expansible, Wilmot's patent
Tumbler and wire punches.
Wipers and rods.

*Appendages on hand for any other arms should be entered in a similar manner as the above, care being taken to arrange them in the same order as the arms are enumerated in Class VI.

COLT'S ARMY PISTOL.

Bullet moulds, casting one round and conical ball.
Bullet moulds, casting six balls.
Cone wrenches.
Screw-drivers and cone wrenches.

Horse Equipments, for Artillery and Cavalry.

Bridles, curb, cavalry pattern.
Bridles, watering, cavalry pattern.
Currycombs.
Carbine sockets and straps, complete.
Cruppers, complete.
Girths, complete.
Halters and straps, cavalry pattern.
Horse brushes, flexible backs.
Horse brushes, cavalry pattern.
Horse covers, rubber, cavalry pattern.
Horse rugs.
Hobbles.
Links, complete.
Lariats.
Mane combs.
Nose bags, cavalry or artillery.
Picket pins.
Saddles, pattern 1859, complete.
Saddles, pattern 1864, complete.
Saddles, Ranger pattern, complete.
Saddles, English riding.
Saddle-bags, cavalry pattern.
Saddle blankets, red, for artillery.
Saddle blankets, blue, for cavalry.
Saddles blankets, gray, for cavalry.
Saddle blankets, rubber.
Saddle cloths, patent.
Spurs.
Spur straps.
Stirrups and straps, cavalry pattern, pairs.
Surcingles, cavalry pattern.

CLASS VIII.—AMMUNITION FOR SMALL ARMS, POWDER, AND ARTICLES FOR ARTILLERY AND SMALL-ARM PROJECTILES.

* Cartridge Bags, filled.

1-lb. blank.
1½-lb. blank.
2-lb. blank.
2½-lb. blank.
6-pdr. Wiard gun.
10-pdr. Parrott gun.
3-inch wrought-iron gun.
12-pdr. mountain howitzer, shell, spherical case, and canister.
6-pdr. field gun, canister, and 12-pdr. field howitzer, shell and canister.
6-pdr. field gun, shot and spherical case, and 12-pdr. field howitzer, spherical case.
12-pdr. Wiard gun.
6-pdr. James gun.
20-pdr. Parrott gun.
30-pdr. Parrott or 4″.2 siege gun.
4.5-inch siege gun.
12-pdr. field gun, shell and canister.
24-pdr. field howitzer, canister.
12-pdr. field gun, shot and spherical case.
24-pdr. field howitzer, shell and spherical case, and 32-pdr. field howitzer, canister.
24-pdr. flank defense howitzer.
32-pdr. field howitzer, shell and spherical case.
12-pdr. siege or garrison gun, and 8-inch siege howitzer.
18-pdr. siege or garrison gun.
24-pdr. siege or garrison gun.
32-pdr. sea-coast gun.
100-pdr. Parrott gun.
42-pdr. sea-coast gun.
8-in. columbiad and sea-coast howitzer.
200-pdr. Parrott gun.
8-inch Rodman gun.
9-inch Dahlgren gun.
300-pdr. Parrott gun.
10-inch sea-coast howitzer.
10-inch columbiad.
10-inch Rodman gun.
12-inch columbiad.
12-inch Rodman gun.
13-inch Rodman gun.
15-inch Rodman gun.
20-inch Rodman gun.
Bursters

* The cartridge bags inclosed in braces are the same size and have the same charge of powder.

Cartridges for Small Arms.

FOR CARBINES AND RIFLES.

Ballard's carbine, copper	Diam. of ball	.44
Ballard's rifle, copper	do.	.45
Ball's and Palmer's carbine, copper	do.	.44
Burnside's carbine, metallic	do.	.56
Burnside's carbine, metallic, (Poultney's patent,)	do.	.56
Cosmopolitan carbine, linen	do.	.52
Colt's rifle, paper	do.	.58
Colt's rifle, sporting size, paper	do.	.44
Gallagher's carbine, metallic	do.	.53
Gallagher's carbine, metallic, (Jackson's patent,)	do.	.53
Gibbs' carbine, linen	do.	.54
Gibbs' carbine, paper	do.	.54
Greene's carbine or rifle, paper	do.	.546
Hall's carbine, paper	do.	.675
Hall's rifle, paper	do.	.52
Henry's carbine, copper	do.	.46
Henry's rifle, copper	do.	.44
Johnson's carbine, copper	do.	.45
Joslyn's carbine, copper	do.	.54
Lindner's carbine, paper	do.	.574
Maynard's carbine, metallic	do.	.52
Maynard's carbine, metallic, (Poultney's patent,)	do.	.52
Merrill's carbine and rifle, paper	do.	.56
Remington's carbine, copper	do.	.43
Sharps' carbine and rifle, linen	do.	.54
Sharps' carbine and rifle, paper	do.	.54
Sharps & Hankin's carbine, copper	do.	.54
Sharps & Hankin's rifle	do.	.55
Smith's carbine, foil, new model	do.	.52
Smith's carbine, rubber, old model	do.	.52
Spencer's carbine and rifle, copper, (can also be used in Starr's new model carbine,)	do.	.55
Starr's carbine, copper	do.	.54
Starr's carbine, linen	do.	.56
Warner's carbine, copper	do.	.515

FOR MUSKETS.

Rifled.

Musket, elongated ball	Diam. of ball	.54
Musket, elongated ball, (.577 and .58 cal.,)	do.	.574
Musket, elongated ball, (for pistol carbine,)	do.	.574

Musket, elongated ball, Johnston & Dow's	Diam. of ball	.574
Musket, elongated ball, Shaler's patent	do.	.574
Musket, elongated ball, Williams' patent	do.	.574
Musket, elongated ball, French	do.	.61
Musket, elongated ball, or musketoon	do.	.69
Musket, elongated ball	do.	.70
Musket, elongated ball	do.	.71
Musket, elongated ball	do.	.73

Smooth-bore.

Musket, buck and ball	Diam. of ball	.69
Musket, elongated ball, Mefford's	do.	.69
Musket, round ball	do.	.69
Musket, round ball	do.	.73
Gun-cotton cartridges.		
Blank cartridges for musket and rifle.		

FOR PISTOLS.

Colt's navy, linen	Diam. of ball	.386
Colt's army, linen	do.	.46
Adams', Allen's, Colt's, Hoard's, Joslyn's, Pettingill's, Starr's, Savage, Remington's, and Whitney's navy, paper	do.	.38
Adams', Allen's, Colt's, Hoard's, Joslyn's, Pettingill's, Starr's, Savage, Remington's, and Whitney's army, paper	do.	.46
Adams', Allen's, Colt's, Hoard's, Joslyn's, Pettingill's, Starr's, Savage, Remington's, and Whitney's navy, skin	do.	.38
Adams', Allen's, Colt's, Hoard's, Joslyn's, Pettingill's, Starr's, Savage, Remington's, and Whitney's army, skin	do.	.46
Adams', Allen's, Colt's, Hoard's, Joslyn's, Pettingill's, Starr's, Savage, Remington's, and Whitney's navy, Johnston & Dow's water-proof and combustible	do.	.38
Adams', Allen's, Colt's, Hoard's, Joslyn's, Pettingill's, Starr's, Savage, Remington's, and Whitney's army, Johnston & Dow's water-proof and combustible	do.	.46
Lefaucheaux, copper	do.	.30
Lefaucheaux, copper	do.	.36
Lefaucheaux, copper	do.	.44
Round ball, for smooth-bore pistols	do.	.54

Fuzes.

METALLIC.

Absterdam.	Parrott's sea-coast percussion.
Bormann, time.	Patterson's percussion.
Bormann, Wright's patent.	Sawyer's combination, time and percussion.
Hotchkiss' percussion, N. M.	Schenkl's combination, N. M.
Hotchkiss' percussion, O. M.	Schenkl's combination, O. M.
Hotchkiss' time.	Schenkl's percussion.
James' percussion.	Sea-coast, time.
Parrott's percussion, N. M.	Tice's percussion.
Parrott's percussion, O. M.	Laidley's time igniter.
Parrott's time.	

PAPER.

2 seconds to the inch.	14 seconds to the inch.
4 seconds to the inch.	15 seconds to the inch.
5 seconds to the inch.	20 seconds to the inch.
6 seconds to the inch.	25 seconds to the inch.
8 seconds to the inch.	30 seconds to the inch.
10 seconds to the inch.	40 seconds to the inch.
12 seconds to the inch.	

WOOD.

6-pdr. field gun.	32 and 42-pdr. sea-coast guns.
12-pdr. field gun.	24-pdr. Coehorn mortar.
3-inch field gun.	8-inch siege mortar.
4.5-inch siege gun.	10-inch siege or sea-coast mortar.
12, 18, and 24-pdr. siege or garrison gun.	13-inch sea-coast mortar.

Lead Balls.

Buckshot,			lbs.
Elongated ball, Colt's pistol, navy,	diam. of ball	.36	lbs.
Elongated ball, Colt's pistol, army,	do.	.44	lbs.
Round ball, for smooth-bore pistols,	do.	.54	lbs.
Elongated, Williams',	do.	.574	lbs.
Elongated, Shaler's,	do.	.574	lbs.
Elongated, regulation,	do.	.69	lbs.
Elongated, Williams',	do.	.69	lbs.
Elongated, Shaler's,	do.	.69	lbs.
Round, regulation,	do.	.69	lbs.

Powder.

Powder, blasting,	lbs.	Powder, mixed,	lbs.
Powder, cannon,	lbs.	Powder, mortar,	lbs.
Powder, damaged,	lbs.	Powder, musket,	lbs.
Powder, experimental,	lbs.	Powder, percussion,	lbs.
Powder, mammoth,	lbs.	Powder, rifle,	lbs.
Powder, mealed,	lbs.		

Miscellaneous.

Birney's composition,	lbs.	Percussion primers for cannon,	no.
Fire balls, 8-inch,	no.	Percussion wafers,	no.
Fire balls, 10-inch,	no.	Portfires,	no.
Flints, musket,	no.	Portfire composition,	lbs.
Flints, rifle,	no.	Priming tubes, filled,	no.
Flints, pistol,	no.	Primers, Maynard's,	no.
Friction tubes or primers,	no.	Primers, navy pattern,	no.
Fuze composition,	lbs.	Primers, Sharps',	no.
Greek-fire tubes,	no.	Rockets, signal, ½-inch,	no.
Greek-fire composition,	lbs.	Rockets, signal, 1¾-inch,	no.
Light balls,	no.	Rockets, signal, 2½-inch,	no.
Lights, blue,	no.	Rockfire,	lbs.
Lights, red,	no.	Safety fuze,	ft.
Match, quick,	lbs.	Shrapnel or spherical case composition,	lbs
Match, slow,	yds.	Torpedoes, truss bridge, (Haupt's patent,)	no.
Pitched facines,	no.	Torches,	no.
Links, tarred,	no.	Valenciennes composition,	lbs.
Percussion caps, Austrian,	no.		
Percussion caps for pistols,	no.		
Percussion caps, regulation,	no.		

In CONGRESS, 29th March, 1779.

CONGRESS judging it of the greateſt importance to preſcribe ſome invariable Rules for the Order and Diſcipline of the Troops, eſpecially for the purpoſe of introducing an uniformity in their formation and manœuvres, and in the ſervice of the camp:

Ordered, That the following Regulations be obſerved by all the Troops of the United States; and that all General and other Officers cauſe the ſame to be executed with all poſſible exactneſs.

By Order,

JOHN JAY, *Preſident.*

Atteſt:—CHARLES THOMPSON, *Sec'ry.*

EXTRACT of an ACT for the Regulating and Governing the MILITIA of the Commonwealth of Maſſachuſetts.

[Paſſed *June* 22, 1793.]

"*AND be it further enacted by the authority aforeſaid*, That the rules of diſcipline approved and eſtabliſhed by CONGRESS, in the reſolutions of the twenty-ninth day of *March*, one thouſand ſeven hundred and ſeventy-nine, ſhall be the rules and regulations of diſcipline to be obſerved by the Militia of this Commonwealth; except ſuch deviations from ſaid rules as may be neceſſary by the requiſitions of this Act, or ſome other unavoidable circumſtances: And every officer receiving a commiſſion in the Militia, ſhall immediately provide himſelf with a book containing thoſe rules."

The recruits being thus far inſtructed, muſt be again taken ſeparately, and taught

The Poſition of a Soldier under Arms.

In this poſition the ſoldier is to ſtand ſtraight and firm upon his legs, with the heels two inches apart, the toes a little turned out, the belly drawn in a little without conſtraint, the breaſt a little projected, the ſhoulders ſquare to the front and kept back, the right hand hanging down the ſide, with the palm cloſe to the thigh, the left elbow not turned out from the body, the firelock carried on the left ſhoulder, at ſuch height that the guard will be juſt under the left breaſt, the fore-finger and thumb before the ſwell of the butt, the three laſt fingers under the butt, the flat of the butt againſt the hip-bone, and preſſed ſo as that the fire-lock may be felt againſt the left ſide, and ſtand before the hollow of the ſhoulder, neither leaning towards the head nor from it, the barrel almoſt perpendicular. When exerciſing, he is to be very exact in counting a ſecond of time between each motion.

The Manual Exerciſe.

I.

Poiſe—Firelock! Two motions.

1ſt. With your left hand turn the firelock briſkly, bringing the lock to the front, at the ſame inſtant ſeize it with the right hand juſt below the lock, keeping the piece perpendicular.

2d. With a quick motion bring up the firelock from the ſhoulder directly before the face, and ſeize it with the left hand juſt above the lock, ſo that the little finger may reſt upon the feather ſpring, and the thumb lie on the ſtock; the left hand muſt be of an equal height with the eyes.

II.

Cock—Firelock! Two motions.

1ſt. Turn the barrel oppoſite to your face, and place your thumb upon the cock, raiſing the elbow ſquare at this motion.

2d. Cock the firelock by drawing down your elbow, immediately placing your thumb upon the breech pin, and the fingers under the guard.

III.

Take Aim. One motion.

Step back about ſix inches with the right foot, bringing the left toe to the front; at the ſame time drop the muzzle, and bring up the butt-end of the firelock againſt your right ſhoulder; place the left hand forward on the ſwell of the ſtock, and the fore-finger of the right hand before the trigger; ſinking the muzzle a little below a level, and with the right eye looking along the barrel.

IV.

Fire! One motion.

Pull the trigger briſkly, and immediately after bringing up the right foot, come to the priming poſition, placing the heels even, with the right toe pointing to the right, the lock oppoſite the right breaſt, the muzzle directly to the front, and as high as the hat, the left hand juſt forward of the feather-ſpring, holding the piece firm and ſteady; and at the ſame time ſeize the cock with the fore-finger and thumb of the right hand, the back of the hand turned up.

V.

Half-cock—Firelock! One motion.

Half bend the cock briſkly, bringing down the elbow to the butt of the firelock.

VI.

Handle—Cartridge! One motion.

Bring your right hand ſhort round to your pouch, ſlapping it hard, ſeize the cartridge, and bring it with a quick motion to your mouth, bite the top off down to the powder, covering it inſtantly with your thumb, and bring the hand as low as the chin, with the elbow down.

VII.

Prime! One motion.

Shake the powder into the pan, and covering the cartridge again, place the three laſt fingers behind the hammer, with the elbow up.

VIII.

Shut—Pan! Two motions.

1ſt. Shut your pan briſkly, bringing down the elbow to the butt of the firelock, holding the cartridge faſt in your hand.

2d. Turn the piece nimbly round before you to the loading poſition, with the lock to the front, and the muzzle at the height of the chin; bringing the right hand up under the muzzle; both feet being kept faſt in this motion.

IX.

Charge with Cartridge! Two motions.

1ſt. Turn up your hand and put the cartridge into the muzzle, ſhaking the powder into the barrel.

2d. Turning the ſtock a little towards you, place your right hand cloſed, with a quick and ſtrong motion, upon the butt of the rammer, the thumb upwards, and the elbow down.

X.

Draw—Rammer! Two motions.

1ſt. Draw your rammer with a quick motion half out, ſeizing inſtantly at the muzzle back-handed.

2d. Draw it quite out, turn it, and enter it into the muzzle.

XI.

Ram down—Cartridge! One motion.

Ram the cartridge well down the barrel, and inſtantly recovering and ſeizing the rammer back-handed by the middle, draw it quite out, turn it, and enter it as far as the lower pipe, placing at the ſame time the edge of the hand on the butt-end of the rammer, with the fingers extended.

XII.

Return—Rammer! One motion.

Thruſt the rammer home, and inſtantly bring up the piece with the left hand to the ſhoulder, ſeizing it at the ſame time with the right hand under the cock, keeping the left hand at the ſwell, and turning the body ſquare to the front.

XIII.

Shoulder—Firelock! Two motions.

1ſt. Bring down the left hand, placing it ſtrong upon the butt.

2d. With a quick motion bring the right hand down by your ſide.

XIV.

Order—Firelock! Two motions.

1ſt. Sink the firelock with the left hand as low as poſſible, without conſtraint, and at the ſame time bringing up the right hand, ſeize the firelock at the left ſhoulder.

2d. Quit the firelock with the left hand, and with the right bring it down the right ſide, the butt on the ground, even with the toes of the right foot, the thumb of the right hand lying along the barrel, and the muzzle being kept at a little diſtance from the body.

XV.

Ground—Firelock! Two motions.

1ſt. With the right hand turn the firelock, bringing the lock to the rear, and inſtantly ſtepping forward with the left foot a large pace, lay the piece on the ground, the barrel in a direct line from front to rear, placing the left hand on the knee to ſupport the body, the head held up, the right hand and left heel in a line, and the right knee brought almoſt to the ground.

2d. Quitting the firelock, raiſe yourſelf up, and bring back the left foot to its former poſition.

XVI.

Take up—Firelock! Two motions.

1ſt. Step forward with the left foot, ſink the body, and come to the poſition deſcribed in the firſt motion of grounding.

2d. Raiſe up yourſelf and firelock, ſtepping back again with the left foot, and as ſoon as the piece is perpendicular turn the barrel behind, thus coming to the order.

XVII.

Shoulder—Firelock! Two motions.

1ſt. Bring the firelock to the left ſhoulder, throwing it up a little, and catching it below the tail-pipe, and inſtantly ſeize it with the left hand at the butt.

2d. With a quick motion bring the right hand down by your ſide.

XVIII.

Secure—Firelock! Three motions.

1ſt. Bring up the right hand briſkly, and place it under the cock.

2d. Quit the butt with the left hand, and ſeize the firelock at the ſwell, bringing the arm cloſe down upon the lock, the right hand being kept faſt in this motion, and the piece upright.

3d. Quitting the piece with your right hand, bring it down by your ſide, at the ſame time with your left hand throw the muzzle directly forward, bringing it within about one foot of the ground, and the butt cloſe up behind the left ſhoulder, holding the left hand in a line with the waiſt-belt, and with that arm covering the lock.

XIX.

Shoulder—Firelock! Three motions.

1ſt. Bring the firelock up to the ſhoulder, ſeizing it with the right hand under the cock.

2d. Bring the left hand down ſtrong upon the butt.

3d. Bring the right hand down by your ſide.

XX.

Fix—Bayonet! Three motions.

1ſt. and 2d. motions the ſame as the two firſt motions of the ſecure.

3d. Quitting the piece with your right hand, ſink it with your left down the left ſide as far as may be without conſtraint, at the ſame time ſeize the bayonet with the right hand, draw and fix it, immediately ſlipping the hand down to the ſtock, and preſſing in the piece to the hollow of the ſhoulder.

XXI.

Shoulder—Firelock! Three motions.

1ſt. Quitting the piece with the right hand, with the left bring it up to the ſhoulder, and ſeize it again with the right hand under the cock, as in the ſecond motion of the ſecure.

2d. Bring the left hand down ſtrong upon the butt.

3d. Bring the right hand down by your ſide.

XXII.

Preſent—Arms! Three motions.

1ſt. and 2d. motion the ſame as in coming to the poiſe.

3d. Step briſkly back with your right foot, placing it at a hand's breadth diſtant from your left heel, at the ſame time bring down the firelock as quick as poſſible to the reſt, ſinking it as far down before your left knee as your right hand will permit without conſtraint, holding the right hand under the guard, with the fingers extended, and drawing in the piece with the left hand till the barrel is perpendicular; during this motion you quit the piece with the left hand, and inſtantly ſeize it again juſt below the tail-pipe.

XXIII.

Shoulder—Firelock! Two motions.

1ſt. Lift up your right foot and place it by your left, at the ſame time bring the firelock to your left ſhoulder, and ſeize the butt-end with the left hand, coming to the poſition of the firſt motion of the ſecure.

2d. Bring the right hand down by your ſide.

XXIV.

Charge—Bayonet! Two motions.

1ſt. The ſame as the firſt motion of the ſecure.

2d. Bring the butt of the firelock under the right arm, letting the piece fall down ſtrong on the palm of the left hand, which receives it at the ſwell; the muzzle pointing directly to the front, the butt preſſed with the arm againſt the ſide; the front rank holding their pieces horizontally, and the rear rank the muzzles of theirs ſo high as to clear the heads of the front rank, both ranks keeping their feet faſt.

XXV.

Shoulder—Firelock! Two motions.

1ſt. Bring up the piece ſmartly to a ſhoulder, ſeizing the butt with the left hand.

2d. Bring the right hand down by your ſide.

XXVI.

Advance—Arms! Four motions.

1ſt. and 2d. the ſame as the two firſt motions of the poiſe.

3d. Bring the firelock down to the right ſide, with the right hand as low as it will admit without conſtraint, ſlipping up the left hand at the ſame time to the ſwell, and inſtantly ſhifting the poſition of the right hand, take the guard between the thumb and fore-finger, and bring the three laſt fingers under the cock, with the barrel to the rear.

4th. Quit the firelock with the left hand, bringing it down by your ſide.

XXVII.

Shoulder—Firelock! Four motions.

1ſt. Bring up the left hand, and ſeize the firelock at the ſwell; inſtantly ſhifting the right hand to its former poſition.

2d. Come ſmartly to a poiſe.

3d. and 4th. Shoulder.

Explanation of Priming and Loading, as performed in the Firings.

Prime and Load! Fifteen motions.

1ſt. Come to the recover, throwing up your firelock, with a ſmart ſpring of the left hand, directly before the left breaſt, and turning the barrel inwards: at that moment catch it with the right hand below the lock, and inſtantly bringing up the left hand, with a rapid motion, ſeize the piece cloſe above the lock, the little finger touching the feather-ſpring; the left hand to be at an equal height with the eyes, the butt of the firelock cloſe to the left breaſt, but not preſſed, and the barrel perpendicular.

2d. Bring the firelock down with a briſk motion to the *priming poſition*, as directed in the 4th word of command, inſtantly placing the thumb of the right hand againſt the face of the ſteel, the fingers clenched, and the elbow a little turned out, that the wriſt may be clear of the cock.

3d. Open the pan, by throwing back the ſteel with a ſtrong motion of the right arm, keeping the firelock ſteady in the left hand.

4th. Handle cartridge.

5th. Prime.

6th. Shut pan.

7th. Caſt about.

8th. and 9th. Load.

10th. and 11th. Draw rammer.

12th. Ram down cartridge.

13th. Return rammer.

14th. and 15th. Shoulder.

N. B. The motion of recover, coming down to the priming poſition, and opening the pan, to be done in the uſual time, the motions of handling the cartridge to ſhutting the pan, to be done as quick as poſſible; when the pans are ſhut, make a ſmall pauſe, and caſt about together; then the loading and ſhouldering motions are to be done as quick as poſſible.

Poſition of each Rank in the Firings.

Front Rank! Make ready! One motion.

Spring the firelock briſkly to a recover, as ſoon as the left hand ſeizes the firelock above the lock, the right elbow is

to be nimbly raifed a little, placing the thumb of that hand upon the cock, the fingers open by the plate of the lock, and as quick as poffible cock the piece, by dropping the elbow, and forcing down the cock with the thumb, immediately feizing the firelock with the right hand, clofe under the lock; the piece to be held in this manner perpendicular, oppofite the left fide of the face, the body kept ftraight, and as full to the front as poffible, and the head held up, looking well to the right.

Take Aim! Fire!

As before explained.

Rear Rank! Make Ready! One motion.

Recover and cock as before directed, at the fame time ftepping about fix inches to the right, fo as to place yourfelf oppofite the interval of the front rank.

Take Aim! Fire!

As before explained.

The recruits being thus far inftructed, the officer muft take twelve men, and placing them in one rank, teach them *to drefs* to the right and left, to do which the foldier muft obferve to feel the man on that fide he dreffes to, without crowding him, and to advance or retire, till he can juft difcover the breaft of the fecond man from him, taking care not to ftoop, but to keep his head and body upright.

When they can drefs pretty well, they muft be taught to *wheel*, as follows:

To the right—Wheel!

At the word of command, the men turn their heads brifkly to the left, except the left hand man.

March!

The whole ftep off, obferving to feel the hand they wheel to, without crowding; the right hand man, ferving as a pivot for the reft to turn on, gains no ground, but turns on his heel; the officer will march on the flank, and when the wheeling is finifhed, command,

Halt!

On which the whole ftop fhort on the foot then forward, bringing up the other foot, and dreffing to the right.

To the left—Wheel!

The whole continue to look to the right, except the right hand man, who looks to the left.

APPENDIX 8

Military Laws and Rules and Regulations for the Army of the United States. Washington, December 1814

Ordnance Department May 1, 1813

1. Of laboratories

There shall be three principal laboratories in the United States, one in the neighborhood of ....; one in the neighborhood of ....; and one near ....

At each of these laboratories, the head of the department will cause to be bought ten acres of land, and have thereon erected work-shops competent to the accomodation of forty workmen, and barracks for the further accomodation of the same, with the necessary magazines and storehouses.

The workmen at each of the said laboratories, shall be engaged for a term of service not less than five years, and at the rates prescribed by law, and at each, there shall be one master wheelwright and carriage maker, and one master blacksmith, the whole to be under the direction of the commissary general, or of some one of his officers. It is, however, understood that if workmen cannot be engaged for a term as long as five years, the commissary general may engage them for a shorter period. And he is also authorized to employ women and children, at low wages, in all work which can be as well performed by them, as by men; and accounts regularly prepared and certified by him, or by the senior officer of ordnance who shall be present, of the amount of all wages for work done under this regulation, shall be paid by the paymaster, of the district, or his assistant.

At these workshops shall be made all gun-carriages, ammunition wagons, travelling forges, and every other apparatus for the artillery, and shall be prepared all kinds of ammunition for garrison and field service.

2. Inspection of powder, etc.

It will be the duty of the commissary general of ordnance, to call upon the commissary general of purchases, for the names and places of residence of all persons engaged in making powder, cannon, cannon shot, or other ordnance stores, under contract with the United States, and on notice of the time of delivery of such articles, he will cause the same to be duly proved and inspected. Until thus previously inspected and proved, no ordnance, cannon balls, shells, shot, or powder, shall be received or paid for by any public agent of the United States.

3. Distribution of Ordnance.

The orders of general officers for the supply of ordnance, ammunition, carriages, etc., shall go no farther than to direct the number and caliber of the guns, the quantity and kinds of ammunition, necessary for the service, and to command the preparation and delivery of these, and other enumerated articles, to some officer charged with their conveyance to the camp or garrison of the general requiring them.

The proportion of overplus small arms, for the infantry, may be one fourth of the number of effective troops in the field: these shall be placed in *reserve,*

at some safe and convenient situation near the army. The proportion of musket catridges for the infantry, shall consist of thirty rounds per man, accompanying the troops in ammunition wagons, and such additional quantities as may be judged requisite, shall be placed in *reserve,* as provided for small arms in the preceding paragraph.

4. Preservation and safe keeping of ordnance stores, etc.

It will be the duty of the commissary general of ordnance to take measures for the completion, reparation, and preservation, of all ordnance, ammunition, artillery carriages, and machines, in the respective fortresses, magazines, and arsenals.

....

23. Of the Arms and Ammunition, with the Methods of preserving them

The preservation of the arms and ammunition is an object that requires the greatest attention. Commanding officers of regiments must be answerable for those of their regiments, and captains for their respective companies.

An officer of a company must every morning and evening inspect minutely into the state of the men's arms, accoutrements and ammunition; and if it shall appear that a soldier has sold, or through carelessness lost or damaged any part of them, he must be confined and punished, and stoppages made of his pay, as hereafter mentioned: For which purpose such officer shall certify to the commanding officer of the regiment the names of the delinquents, and the losses or damages which shall appear of their arms, ammunition and accoutrements; and the commanding officer, after due examination, shall order stoppages to be made for whatever shall appear to have been sold, lost or damaged as aforesaid. The stoppage to be as follow:

For a firelock, sixteen dollars;
 a bayonet, two dollars;
For a ramrod, one dollar;
 a cartridge-box, four dollars;
 a bayonet belt, one dollar;
 a scabbard, two thirds of a dollar;
 a cartridge, one sixth of a dollar;
 a flint, one twentieth of a dollar;
 a gun-worm, one fourth of a dollar;
 a screw-driver, one twelfth of a dollar;
And for arms, accoutrements and ammunition damaged, such sums as the repairs shall cost the States, to be estimated by the brigade conductor, or, when a corps is detached, by such person, as its commanding officer shall appoint for that purpose; provided that such stoppages do not exceed one half of the delinquent's pay monthly.

It is highly essential to the service that the ammunition should be at all times kept complete; for which purpose, as often as it is necessary, a return is to be made by each company of the number of cartridges deficient, to the quartermaster, that he may make out a general one for the regiment, to be signed by the commanding officers of the regiment and brigade, and no time lost in supplying the deficiency. The like care is to be taken that all deficiencies of arms and accoutrements are supplied without loss of time.

All arms, accoutrements and ammunition unfit for service, are to be carefully preserved, and sent by the commanding officer of each company to the regimental quarter-master, who shall deliver the same to the brigade conductor, they respectively giving receipts for what they receive. The arms, accoutrements and ammunition of the sick and others, when delivered up, are to be taken care of in the same manner. Before the cartridge boxes are put in the arm chests, the cartridges must be taken out, to prevent any loss or accident.

A conductor shall be appointed to each brigade, who shall have under his immediate care and direction, a travelling forge and five or six armourers, an ammunition waggon, and a waggon with an arm-chest for each battalion, each to hold twenty-five arms, to receive the arms and accoutrements wanting repair, or of the men sick or absent; and when the arms delivered in by a battalion shall exceed the above number, the surplus shall be sent to the commissary of the military stores.

The brigade conductor shall issue no ammunition but by order of the commanding officer of the brigade; but may receive and deliver the arms and accoutrements of each battalion, by order of its commanding officer.

The ammunition waggons shall contain twenty thousand cartridges; and in order to keep the same complete, the conductor shall, as deficiencies arise, apply to the field commissary, or one of his deputies, for a supply, or otherwise for the necessary materials of cartridges, and to the major of brigade for men to make them up under the direction of the conductor; and for this purpose the brigade major shall order out a party of the most careful soldiers.

The non-commissioned officers of each company will be provided with gun-worms; and every day, at the noon roll-call of the company, those men who have returned from duty are to bring their arms and have their charges drawn; the first serjeant to receive the powder and ball, and deliver the same to the quarter-master.

APPENDIX 9

REGULATIONS

TO BE

RECEIVED AND OBSERVED

FOR THE

DISCIPLINE OF INFANTRY,

IN THE

ARMY OF THE UNITED STATES.

ADJUTANT GENERAL'S OFFICE,
WASHINGTON CITY, 19th March, 1819.

GENERAL ORDERS.

The "Hand Book for Infantry," compiled and published by William Duane, of Philadelphia, will be received and observed as the system of Infantry Discipline for the Army of the United States.

By order of the Secretary of War,
T. H. CUSHING, Adjt. Genl.

A

HAND BOOK FOR INFANTRY:

CONTAINING

THE FIRST PRINCIPLES

OF

MILITARY DISCIPLINE,

FOUNDED ON RATIONAL METHOD:

INTENDED

TO EXPLAIN IN A FAMILIAR AND PRACTICAL MANNER,

FOR THE USE OF THE MILITARY FORCE OF THE UNITED STATES,

THE

MODERN IMPROVEMENTS

IN THE

DISCIPLINE AND MOVEMENT OF ARMIES.

THE NINTH EDITION.

BY WILLIAM DUANE,

ADJUTANT GENERAL IN THE ARMY OF THE UNITED STATES.

C'est la discipline militaire qui fait la gloire du soldat et la force des armées, car elle est le plus grand acte de son dévouement et le gage le plus assuré de la victoire.
CARNOT, 1811.

PHILADELPHIA:

PRINTED FOR THE AUTHOR.

CHAP. XII.

THE MANUAL EXERCISE.

§ 1. FOR several years the most important object of military discipline was supposed to consist in the performance of certain unmeaning and frivolous motions with the firelock in the hands, which was called the Manual Exercise on that account. During the last ten years this dangerous error has been in a great measure corrected in the general judgment, and it is now perceived and acknowleged, that beside the acquisition of exactness in the handling of the firelock, and loading and firing correctly, and with skill....the knowlege of the different parts of the firelock....the name of each part and its use; every thing else of the manual exercise is superfluous, or at best ornamental for parades only.

The manual exercise properly consists of two parts; a manual of discipline, and a manual of parade.

In the manual of discipline should be comprehended all the motions that are required under all circumstances in the use of the firelock for action. The second part would comprehend the first, together with all those motions which are necessary for a parade, for guard, for marching, for convenience, or for show.

The only effectual parts of the manual, are those which go into action, they are the priming, loading and firing, the fixing and charging of bayonets, and the manner of carrying the firelock; all other motions are motions of *convenience*, and therefore proper to be observed....or motions of *parade* or respect, which may be preserved or rejected without disadvantage. Among the motions of convenience are the *slope*, *trail*, *advance*, *support*, the *secure* and the *stacking* or *filing* of arms; motions have been in use which are improper, such as grounding arms. It is strictly in the spirit of good discipline, not to accustom men to any motions which convey *humiliating ideas;* an American citizen must disdain submission to any invader. The *laying down arms* being the last act of subjection of a vanquished army, and like passing under the yoke among the ancients, has been banished from our exercise.

Independent of the policy, there is also utility in rejecting the motions of grounding and taking up firelocks. On service in the field it is never proper nor useful....on duty as centinels, it is not admissible; and as a matter of prudence and economy, it ought not to be suffered. Iron acquires rust very rapidly in every part of our country. Laying the firelock on the moist earth or grass, is therefore destructive to arms and to ammunition. The stacking of arms by two contiguous files in the order of two deep, or in the order of three deep, is now the mode adopted; stacking the firelocks of the three is easy, by facing the centre rank to the right, and stepping with the left foot six inches backward; and the front rank coming to the right about; the firelocks stand in regular order: they are secured from moisture, and are easily resumed by the members on returning into the ranks.

§ 2. FIRST DRILL OF THE MANUAL.

The drill of the manual should comprehend all that is practical in the motions made in actual priming and loading, and the carriage of the firelock in battalion; and afterwards all that is merely ornamental. The preliminary drill with the firelock should commence with the priming and loading.

The soldier having taken his place in the rank for drill with ordered arms, the precaution is given:

Attention!

The soldier stands firm, his eyes to the front, his left hand down by his side, not constrained but straight; his right hand fingers on front of the firelock, the but of which is close to his right foot and dressed with it; the barrel rests against the right shoulder, the thumb of the right hand behind the barrel, the arm a little bent....and the following motions are executed in the manner described:

1. ***Recover arms.***
2. ***Open pan.***
3. ***Handle cartridge.***
4. ***Prime.***
5. ***Shut pan.***
6. ***Load.***
7. ***Draw ramrod.***
8. ***Ram down.***
9. ***Return ramrod.***
10. ***Make ready.***
11. ***Aim.***
12. ***Fire.***
13. ***Half cock.***
14. ***Shoulder arms.***
15. ***Shut pan.***
16. ***Order arms.***

EXPLANATIONS.

RECOVER ARMS....*Two motions*....1. The right arm, which was somewhat bent, is straightened, and the firelock is seized as low down as is practicable without stooping. 2. The firelock is brought briskly up, perpendicular in front of the right arm, so that the left hand catches the stock at the swell, the right hand holds the handle or small of the stock, the ramrod to the front.

OPEN PAN....*Three motions*....1. The firelock is now lowered to the *port* or priming position, the piece resting on the left hand, the butt thrown by the right side, so that it rests about the hip, with the person of the soldier half faced to the right. The muzzles of the rank of the same elevation will all range to the front; on about a level with the top of the head. 2. As the firelock is brought to the slope, the right foot is raised, and the body gently half faced to the right. 3. The hammer is thrown open with the thumb of the right hand.

HANDLE CARTRIDGE....*two motions*....1. The right hand opens the cartridge box, seizes the cartridge, shuts the case of the cartridge box. 2. Bite the top of the cartridge off.

PRIME....*two motions*....1. Pour the priming into the pan. 2. Bring the two latter fingers of the hand before the hammer.

SHUT PAN....*two motions*....1. With the cartridge between the two fore fingers and thumb, the pan is shut by the third and fourth fingers hooked. 2. The but is then suffered to sink gently through the left hand to the front, so that when it reaches the ground the but shall rest on the ground opposite the toe of the left foot, and the muzzle sloped so as to stand in front of the right breast 10 inches from the body.

LOAD....*one motion*....The cartridge is then emptied into the muzzle and the empty paper pushed in with the finger.

DRAW RAMROD....*two motions*....1. The rammer is then seized with the thumb and two first fingers of the right hand, and drawn up about a foot, with the right hand so turned that the back of the hand shall be towards the face, and the little finger uppermost. 2. The rod is thus drawn out and the hand adroitly turned so that the broad end of the rammer shall be placed in the muzzle and the little finger undermost.

RAM DOWN....*two motions*....1. When firing with powder the firelock is raised perpendicular and a slight stroke is given with the heel of the but on the ground to level the powder. 2. The wadding is then rammed down the barrel in the perpendicular position.

RETURN RAMROD....*two motions*....1. The rammer is again briskly raised eight inches or a foot with the thumb and two fingers, and as before seized with the reversed hand, drawn out, and turned. 2. The ramrod is returned to its place with a pressure of the palm of the hand; the body still retaining its half faced positions.

MAKE READY....*Two motions*....1. The firelock is now brought up to the same position as on the word *recover arms;* the left hand holding the firelock perpendicular opposite the left eye; the right hand holds the but at the grasp. 2. The firelock is cocked with the thumb of the right hand.

AIM....*Two motions*....1. The firelock held by the right hand is now thrown gently into a horizontal position to the front, and caught on the palm of the left hand which is easily extended with an elbow slightly bent to the front; the sole of the but is placed against the right shoulder. 2. The right foot is thrown back about six inches, and the left eye being shut the right eye glances along the barrel.

FIRE....*Two motions*....1. The fore finger of the right hand pulls the tricker; and, 2. as soon as the fire is made, the firelock is again brought to the *port* or priming position; or the word *recover arms* is given when firing has ceased; and it is followed in either case by

[The use of the second finger at the tricker is recommended where the structure of the hand will allow it; the fore finger will then be placed before the guard of the tricker and the middle finger within; this method prevents any jarring of the firelock in the act of firing.]

HALF COCK....*One motion*. ..If this be done as preparatory to firing, it is done in the priming position, sloped to the front by seizing the cock with the fore fingers and thumb of the right hand; if it follows the *recover*, then it is followed by *Shoulder arms;* but if the firing continues, then the position half faced to the right is retained, and priming and loading goes on in that position. When the firing is closed, then

SHOULDER ARMS....*four motions*....1. The left hand, which held the firelock with the arm a little bent below, is now carried as low down as possible without bending the body. 2. The firelock is brought up to the shoulder so that the left hand shall with

the back in front be as high as the eyes. 3. The right hand crosses the body at the same instant, and holds the but at the grasp under the lock, and the left hand quitting its hold, is brought down open and flat, and *tells* upon the but, the thumb to the front, the sole of the but lying well on the half palm and inner joint of the fingers forming a hollow in the hand, upon which it rests so that the barrel shall be perpendicular. 4. The body fronts as the firelock reaches the shoulder.

Shut Pan....*Three motions*....1. The firelock being at the shoulder, the right hand open is carried across the breast. 2. The pan is shut with the palm. 3. The hand brought again to the right side.

Order Arms....*Three motions*....1. The firelock held on the left hand with an elbow somewhat bent, not so much as to place the but too low, is now lowered the whole length of the left arm. 2. The right hand seizes the firelock above the lock. 3. Brings it across the body, to the right side, where it is suffered to slide perpendicular to the first position on the outside of the right foot.

§ 3. MANUAL OF PARADE.

The soldier reaches parade with his arms trailed or sloped; and on falling in he comes to an order at ease without word of command. On the beat of the drum as a preparative, or command of the officer....*attention*, the ranks *dress* to the right or left as required. The officer then gives the precaution.

Take care to perform the manual exercise of parade.

1. *Fix bayonets.*

In this motion, the firelock is seized with the left hand, about the upper band, and without moving the but from the side of the right foot, is thrown easily in front of the body in a sloping position; the right hand is carried at the same moment between the firelock and the body to the bayonet, which is seized and fixed briskly on the firelock, which is then brought into the position of the order.

2. *Prime and load.*

This comprehends the ten first motions in the first drill of the manual; here it is executed at one word of command, the motions are....1. *recover* from the order....2. open pan....3. handle cartridge....4. prime....5. shut pan....6. load....7. draw ramrod....8. ram cartridge....9. return ramrod....10. make ready.

3. ***Make ready.***
4. ***Take aim.***
5. ***Fire.***
6. ***Half cock.***
7. ***Charge bayonet.***
8. ***Prime and load.***
9. ***Present arms.***
10. ***Advance arms.***
11. ***Order arms.***
12. ***Handle arms.***
13. ***Unfix bayonet.***
14. ***Trail arms.***
15. ***Shoulder arms.***
16. ***Support arms.***
17. ***Carry arms.***
18. ***Secure arms.***
19. ***Shoulder arms.***
20. ***Slope arms.***

The manual of parade consists of twenty words of command, in the strict order of duty in action, beside the firing motions of the first drill; the eighth is the precautionary load after a successful charge, and the enemy has been defeated; and the advance a motion of ease, on resuming the order of parade after action; the ninth, the salute to the commanding officer after victory; and the trail and order, the movements of ease and rest after action.

Here the repeated *shouldering*, the *grounding*, and *taking up*, are all omitted; and no motion is repeated but the priming and loading motions, which cannot be too often or dextrously performed.

The manual of discipline should comprehend all these motions, and convey plain ideas of the duties to be performed.— The disciplinary and parade manual then might begin with the motions indicative of this principle, as fixing bayonet, and priming and loading.

There remains but to explain the motions of the manual of parade and discipline not before described.

EXPLANATIONS.

Fix bayonet....This operation is performed in two modes, at the right and at the left side. At the right side, it is performed at the order, by drawing the bayonet from the scabbard and fixing it on with the right hand, and letting the firelock remain at the order. This is the shortest and best method; the other

method from the shoulder, may be performed from the shoulder, in five motions, in this manner: at the word *fix bayonets*, 1. the right hand crosses the body and holds the grasp; 2. the left hand is carried up and seizes the firelock; 3. it is brought down with the left hand to the left side; 4. the bayonet is there fixed, which is followed, 5. by the shoulder.

CHARGE BAYONET....*Two motions*....1. seize the firelock at the handle. 2. Bring it to a horizontal position in front, the but on a level with the hip, the right hand thrown a little behind the right side with the arm bent, and the left hand holding the firelock firmly at the swell.

PRIME AND LOAD—(As before.)

PRESENT ARMS....*Four motions*....1. Seize the firelock at the handle with the right hand, bring it to the front of the left eye with the *lock* in front. 2. Strike the firelock with the palm of the left hand on the sling or ramrod, the cock on a level with the nipple of the left breast. 3. With the right hand sink the but in front of the left thigh, so that the cock may be on a range with the navel; the barrel in front of the left eye, the lock to the right side and left hand gently grasping the firelock at the swell. 4. The right foot drawn back so as that the heel of the left foot shall be near the hollow of the right.

ADVANCE ARMS....is the position in which serjeants carry their arms, in battalion; it may be executed from the shoulder, the order, the recover, or the present; it consists in bringing the firelock to the right side, in such a way as that the barrel shall rest against the right shoulder; the right hand first and second fingers shall be placed under the guard....the third and fourth fingers behind the stock....and the thumb on the top of the guard—and the firelock thus suspended with an easy bent arm.

ORDER ARMS....*four motions*....1. Carry the left hand across the breast, and seize the firelock with the left hand firmly in its place. 2. Carry the right hand up in front of the firelock and seize it with the right hand in its place. 3. Withdraw the left hand and bring it handsomely to the left side. 4. Bring down the firelock with the but briskly to the ground at the same instant; fingers in front.

HANDLE ARMS....This word of command may be used to bring the rank to dress when the men are at ease, when they usually hold the firelock with the right hand about the muzzle; then it consists in bringing the hand down to the front, with the thumb behind the barrel....in the case of the hand being already extended down, it is used as a preparative for fixing bayonet, or as a corrective of an imperfect execution of the motion with the hand down....in both cases it consists of *one motion* only.

UNFIX BAYONETS....*four motions*....1. Throw the muzzle of the firelock forward from the order with the right hand. 2. Force the bayonet by striking the ball of the right thumb against the shoulder and unscrew the bayonet. 3. Return the bayonet to the scabbard. 4. Draw back the firelock to the position of the order with the hand in front of the piece below. 5. Carry the left hand to the left side.

This command may be executed from the shoulder in *four motions*. 1. Carry the right hand under the lock to the band of the firelock. 2. Carry the left hand up so as to hold the firelock easily. 3. Bring the firelock down to the left side, let the muzzle rest against the left arm. 4. Unfix the bayonet and return it to the scabbard. In this case it may be followed by *shoulder* or the *recover*, and *firing motions*.

TRAIL ARMS....*two motions*....May be executed from the order, from the shoulder, or the advance: It consists, 1. In seizing the firelock with the right hand, sufficiently low down on the swell. 2. Carry it down to the right side, so that the firelock shall slope about eight inches in front of the body by the right side, and the buts of the rank shall dress behind, and the muzzles dress in front.

SHOULDER ARMS....(As before.)

SUPPORT ARMS....*two motions*....Is a motion executed from the shoulder, and is performed by, 1. Throwing the right hand across the body, and seizing the firelock by the handle. 2. Throwing the left hand over the right arm, so that the cock of the firelock shall rest on the left arm.

CARRY ARMS....*two motions*....Is simply, 1. Carrying the left hand to the but, and making it tell, and holding the firelock at the shoulder. 2. The right hand at the same moment resuming its place by the right side.

SECURE ARMS....*three motions*....This is a motion to secure the arms against rain or weather; it is performed from the shoulder. 1. Carry the right hand across the body to hold the firelock. 2. The left hand is thrown up in front of the barrel. 3. The muzzle of the firelock is brought on the left hand down to the front, sloped towards the ground, and within from four to six inches; the lock comes under the left arm; the toe of the

SLOPE ARMS....*one motion*....Is performed from the shoulder, and consists in throwing the firelock into a gent'e slope on the shoulder, so that the but shall advance three or four inches in front.

The *secure* and the *trail*.. .are never performed with fixed bayonets.

§ 4. OF THE FIRE.

Of all the branches of the military art, none has undergone a greater variety of changes, none has been so long ill digested and complicated, as the mode of fire. It has been a matter of dispute among the most distinguished officers for a century; each endeavoring to bring it to perfection in his own way; by charging carefully,...by charging with given proportions of powder....by ramming down....by dispensing with the ramrod and depending upon the weight of the ball and the shock of the but against the ground; then came the principles of extension, or of giving a long line of fire....then the order of formation in two, three, four ranks, one or two of which kneeling....then the volley firing; firing by ranks, by sub-divisions and platoons; the kneeling of front ranks; and at last, the execution of the greatest number of discharges of the fire'ock in a minute, as Guibert very truly says, only encreasing the noise, smoke, and confusion of action, without any other effect.

For a long time it was not perceived, that in order to render fire effective, the exercise of loading and firing should be plain and unincumbered by useless motions; that loading carefully was essential to the regular effect; and that excessive hurry, or making a greater or lesser number of explosions, was not the object, but to produce effect by the shot. In time it came to be discovered, that in act'on not one shot out of 100 hit an extended object as high as the head of a horse, at three hundred feet distance: and then distance became a consideration; the cool, deliberate and effective fire of the militia corps in the war of our revolution, tended to introduce into European warfare considerations on the inefficacy of the fire, as then practised in their armies. In real service it is impossible, after the first fire, to keep up a regular volley, or even a platoon fire, modern tactics has therefore exploded the old theories, and reserved the fire of divisions, or platoons, only for special circumstances, instead of being the general regulation; the practice now in all armies is the fire deliberate and composed as each man loads.

In like manner it was found, that in the tumult of action the *rear of the three ranks* killed more men of their own front rank than fell by the balls of the enemy; the rear rank now loads its firelocks for the centre rank; and the centre rank men load their own and fire their own firelocks, as well as those of the rear rank, in the following manner: the order of formation being files of three in depth; the front rank man loads and fires his own piece: the centre rank man fires his own piece, brings it down in his left hand, and presents it to the left hand of the rear rank man; the rear rank man hands his own loaded piece with his right hand into the right hand of the centre rank man who fires it, and loads the rear rank man's piece and fires it; and then returns it and receives and fires his own, loads and fires it, and returns it. Thus the centre rank man loads only one of every two shots he fires; the rear rank man does nothing but load.

Plate 10, presents to the eye these dispositions: the first or three upper figures represent a file of three deep, the front and centre rank men firing, the rear rank man priming. The second group represents the same file of three, the front rank firing, the centre rank priming after his first fire, and the rear rank loading; the third group represents the front rank firing, the second rank faced about delivering the firelock he had fired to the rear rank man, who presents his firelock, loaded, to the centre rank man.

Experience also taught that in order to know the use of the firelock, it was necessary to examine how the shot acts, in order to obtain definite ideas.

First, on the *line of level*, that is to say, the straight line, from the eye to the object at which the ball is directed.

Secondly, the *line of fire*, a straight line, which represents the axis of the musket.

Thirdly, the *line of trajection* described by the ball which is projected by the powder from the calibre of the piece to the spot it is intended to strike.

The *line of level*, and the line of *fire*, are by no means parallel, for according to the different weight of metal which the barrel has at its breaching, and at its muzzle, they describe an angle more or less acute beyond the tube; the eye seeks its aim along the exterior of the barrel, while the ball put in motion is impelled from the interior part of the barrel, to the length of the line of fire; but the line of level and the line of fire become secant at certain distance, or in other words cross each other.

On the delivery of the ball from the cylinder, its path begins to trace a curve line ascending, which is begun by the body in motion, at a small distance from the mouth of the barrel, and immediately cuts the line of level, passing it upward at a certain distance ; from thence at a given distance it is drawn to the earth by gravitation, and inclines to the level line, cuts it again, and finishes its parabolic course to the end of its fall ; it is this second point of intersection which is called the *point blanc ;* and which in proportion to the inclination of the angle which is formed by the line of level and the path of the ball, is more or less distinct from the extremity of the barrel, and thus in the same manner they act in proportion to the force which impels the ball, from its own volume, from that of its density, from the resistance of the air in the space which it traverses, and the length of the calibre, proportioned according to the diameter.

The *point blanc* or the *white spot*, is so named from the French who painted their targets black, and the central spot *white.*

What is here said relates to a common property of all fire arms ; and all round shot from a smooth calibre proceed in this curvilinear course. The horizontal shot of a musket may be computed at 180 toises, or 1080 feet, yet where the fire of infantry can have any great effect, it is seldom more than at 80 toises, 160 yards, or 480 feet ; that is of infantry arranged in battle, and in the tumult of an action. Beyond this distance the shot is uncertain, for the soldier in his hurry and confusion loads hastily, levels worse, trusts to chance in his fire, and is usually devoid of that composure which could insure execution.

The soldier having, by the manual exercise, acquired a perfect habit in his loading and in his fire, at first exercised alone, then in file, afterwards in the front, centre and rear of the file, in several files by division, and in company, he should next be conducted by practice through the same gradations to fire with ball at a target, upon the principle of the course of the ball ; and to know, that the *aim* must be taken high or low according to the distance of the object fired at.

Particular attention to the quality and condition of the arms, is an essential part of military duty ; the French consider it economical to provide one serviceable firelock instead of five or ten that will not stand a day's service.

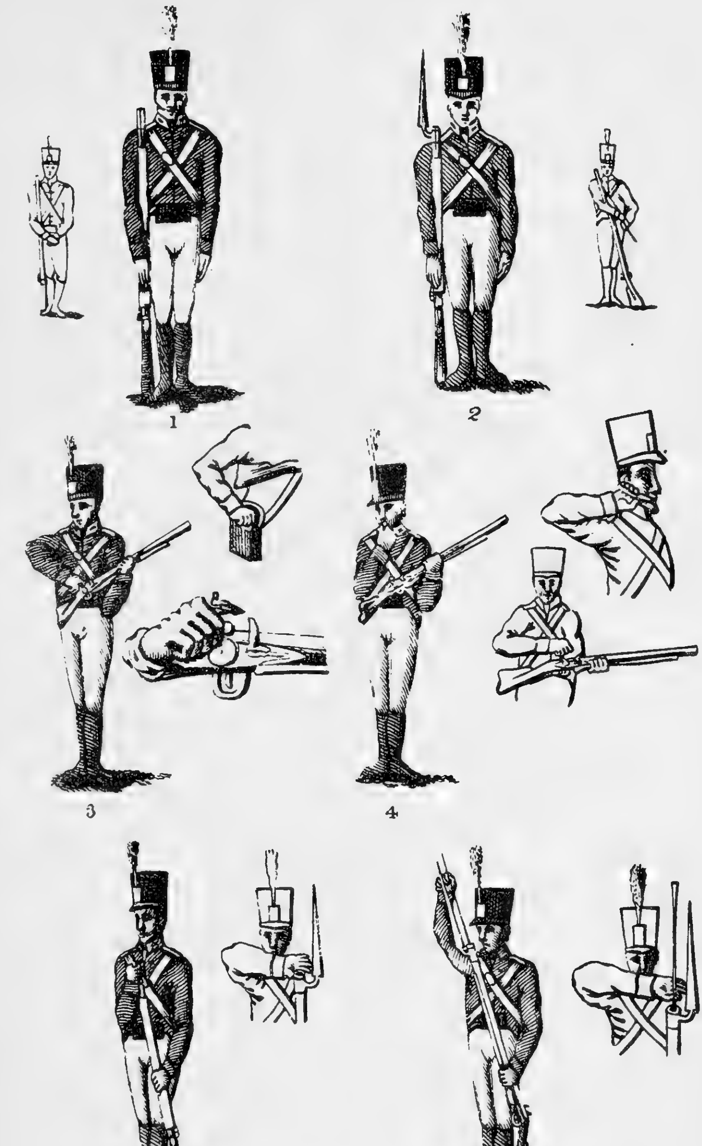


Plate 8

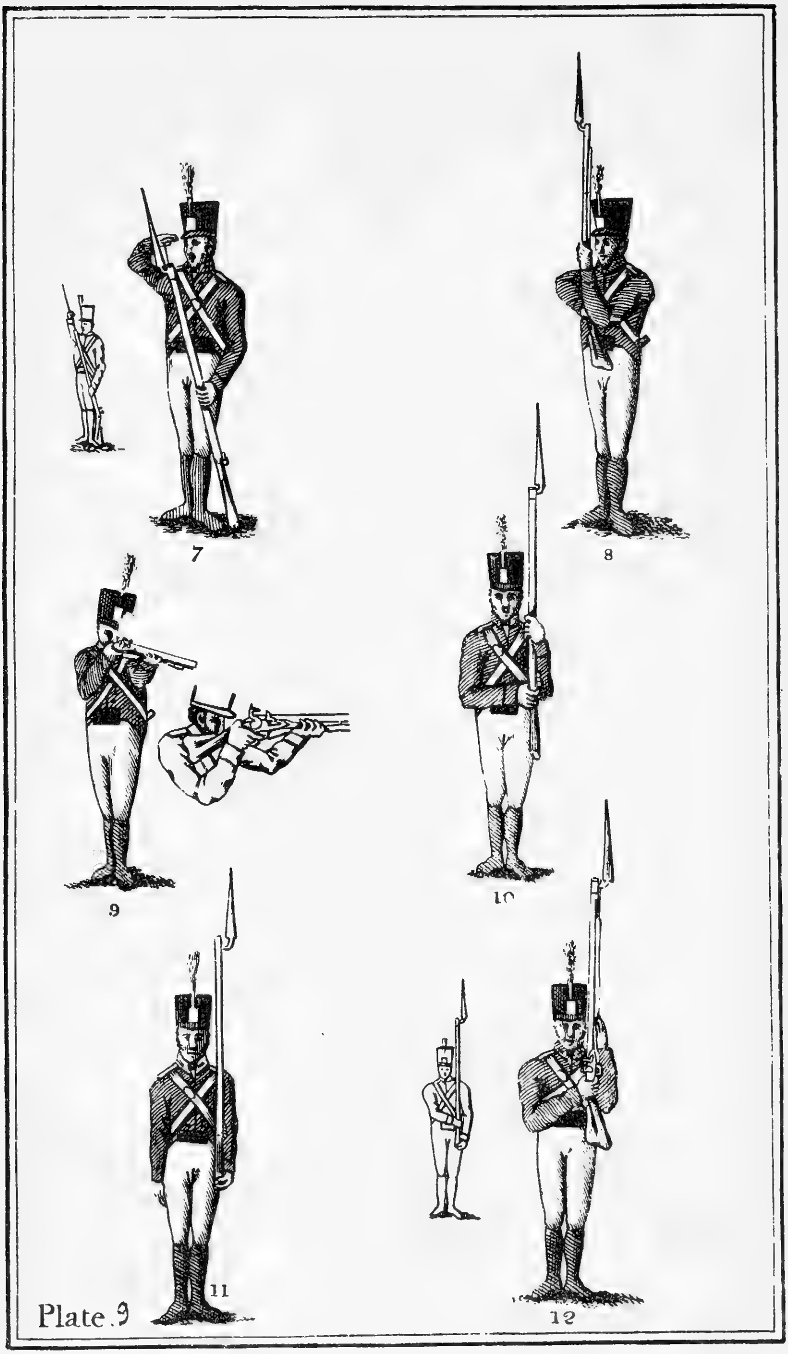


Plate. 9

Plate. 10

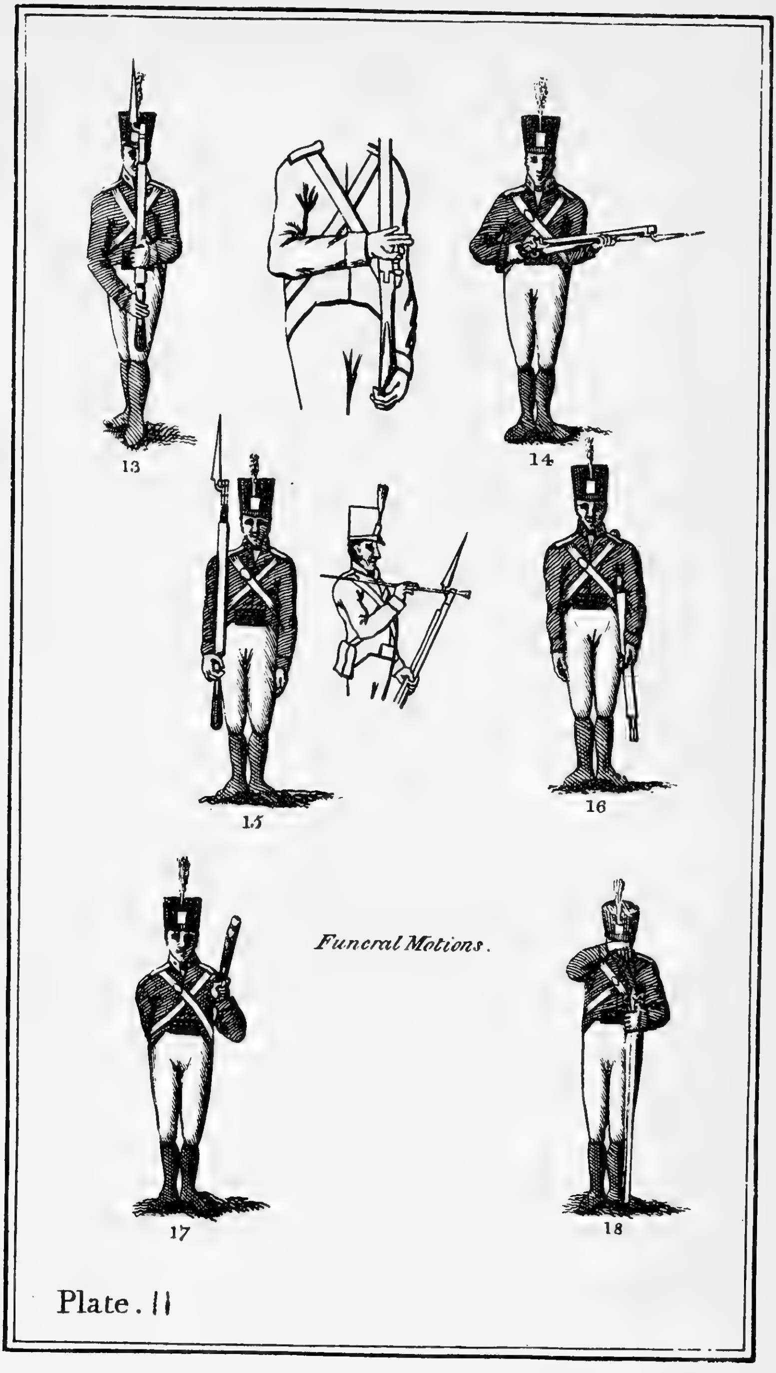


Plate. 11

CONCISE SYSTEM OF INSTRUCTIONS AND REGULATIONS

FOR

THE MILITIA AND VOLUNTEERS

OF THE UNITED STATES,

COMPREHENDING

THE EXERCISES AND MOVEMENTS

OF

The Infantry, Light Infantry, and Riflemen; Cavalry and Artillery:

TOGETHER WITH

The manner of doing duty in Garrison and in Camp, and the forms of

PARADES, REVIEWS, and INSPECTIONS,

As established by authority for the government of the Regular Army.

PREPARED AND ARRANGED BY

BREVET CAPTAIN S. COOPER,

Aid de Camp and Assistant Adjutant General.

UNDER THE SUPERVISION OF

MAJOR GENERAL ALEXANDER MACOMB.

Commanding the Army of the United States.

Philadelphia:

ROBERT P. DESILVER, No. 255 MARKET STREET

1836.

LOAD IN TWELVE TIMES.—LOAD.—(FIG. 7.) 1st mo. As the first motion of CHARGE–BAYONET, except that the hollow of the right foot is brought up against the left heel.

2d mo. Bring down the piece with the right hand into the left, which, at the instant, seizes it at the tail-band, the thumb extended on the stock, the butt under the right fore-arm, the handle against the body and about two inches under the right breast, the muzzle at the height of the eye, the guard turned a little out, the left elbow supported against the side. At the instant the piece falls into the left hand, the right thumb is placed on the steel above the flint, the fore-fingers closed, the right fore-arm along the butt.

2. OPEN–PAN.—Open the pan, by pushing forward the steel with the right thumb, the left hand resisting and holding the piece firm; draw back immediately the right elbow, carry the hand to the cartridge-box, passing it between the butt and the body, and open the box.

3. HANDLE–CARTRIDGE.—Seize a cartridge with a thumb and the two next fingers, and place it between the teeth, the right hand passing between the butt and the body.

4. TEAR–CARTRIDGE.—Tear the paper down to the powder, holding the cartridge upright between the thumb and next two fingers; in this position place it against the pan, the palm of the right hand turned towards the body, the right elbow supported on the butt.

5. PRIME.—Drop the head a little, fix the eyes on the pan, fill it with powder, press together the top of the cartridge with the thumb and fore-finger, raise the head, and place the two last fingers of the right hand firmly behind and against the steel.

6. SHUT–PAN.—Resisting the motion with the left hand, shut the pan smartly with the fingers behind the steel, holding carefully the cartridge with the two next fingers and the thumb; seize immediately the handle with the two remaining fingers and the palm of the right hand, the right wrist touching the body, the elbow back, and a little detached from the body.

7. CAST–ABOUT.—(FIG. 8.) 1st mo. Pass the piece

along the left thigh, after bringing it upright near the body; to effect this, press the butt strongly, extending smartly the right arm, without lowering the shoulder; turn at the same time the rammer towards the body, open the left hand to let the piece slide through it towards and near the middle band, the elbow remaining near the body, the cock bearing on the right thumb; at the same time face to the front, turning on the left heel, and carry the right foot forward, the heel against the hollow of the left foot.

2d mo. Quit the hold of the right hand; through the left, let the piece descend to the ground, without shock, along and near the body; raise at the same time the right hand to the height of, and near the muzzle, holding the top of the cartridge up, the left hand against the body, the piece touching the left thigh, the muzzle opposite to the centre of the body.

8. CHARGE–CARTRIDGE.—(Fig. 8.) Fix the eye on the muzzle, turn quickly the back of the right hand towards the body, in order to discharge the powder into the barrel; raise the elbow to the height of the wrist, shake the cartridge, force it into the muzzle, and leave the hand reversed, the fingers bent but not clenched.

9. DRAW–RAMMER.—1st mo. Drop smartly the right elbow and seize the rammer between the thumb and fore-finger bent, the other fingers shut; draw it smartly extending the arm; seize the rammer again at the middle, between the thumb and fore-finger, the hand reversed, the palm to the front, the nails up; the eyes following the movement of the hand; clear the rammer from the pipes by again extending the arm.

2d mo. Turn rapidly the rammer between the bayonet and the face, closing the fingers, the rammer of the rear-rank man grazing the right shoulder of the man in front the rammer parallel to the bayonet, the arm extended, the butt of the rammer opposite to the muzzle, but not yet inserted, the eyes fixed on the muzzle.

3d mo. Insert the butt of the rammer and force it down as low as the hand.

10. RAM–CARTRIDGE.—(Fig. 9.) Extend the arm to its full length to seize the rammer between the right thumb extended and the fore-finger bent, the other fingers closed; with force ram down twice, seize the rammer at the little end, between the thumb and fore-finger bent, the other fingers closed, the right elbow touching the body.

11. RETURN–RAMMER.—1st mo. Draw briskly the rammer, seize it at the middle between the thumb and fore-finger, the hand reversed, the palm to the front, the nails up, the eyes following the movement of the hand; clear the rammer from the barrel by extending the arm.

2d mo. Turn rapidly the rammer between the bayonet and the face, closing the fingers, the rammer of the rear-rank man grazing the right shoulder of the man in front, the rammer parallel to the bayonet, the arm extended, the little end of the rammer opposite the first pipe, but not yet inserted; the eyes fixed on that pipe.

3d mo. Insert the little end, and with the thumb force it as low as the middle band; raise quickly the hand a little bent, place the little finger on the butt of the rammer, and force it down; lower the left hand on the barrel to the extent of the arm, without depressing the shoulder.

12. SHOULDER–ARMS.—1st mo. Raise the piece with the left hand along the left side, the hand at the height of the chin, the fore-arm touching the piece, the barrel to the front; drop at the same time, the right hand to seize the piece a little above the handle, the fore-fingers touching the cock, and the thumb on the counter-plate.

2d mo. Raise the piece with the right hand, drop the left, and place it under the butt, bring back the right heel to the side of the left, and on the same line; support the piece with the right hand against the shoulder, in the position prescribed for SHOULDER–ARMS, the right hand resting on without grasping the piece.

3d mo. Let fall smartly the right hand into its position, by the side of the thigh.

READY.—(Fig. 10.) 1st mo. As the first motion of the first time of load.

2d mo. Bring the piece with the right hand to the middle of the body, place the left hand, the little finger touching the feather-spring, the thumb extended on the stock at the height of the chin, the counter-plate almost turned towards the body, the rammer obliquely to the left and front.

3d mo. Place the thumb on the head of the cock, the fore-finger under and on the guard, the other three fingers joined to the first, the elbow at the height of the hand.

4th mo. Close the right elbow smartly to the body in cocking; seize the piece at the handle, let it descend along the body in the left hand to the tail-band, which remains at the height of the shoulder.

AIM.—(Fig. 11, 12.) Drop smartly the muzzle, the left hand remaining at the tail-band; support the butt against the right shoulder, the left elbow a little down; shut the left eye, direct the right along the barrel, drop the head upon the butt to catch the object, and place the fore-finger on the trigger. The rear-rank at the same time places the right foot about eight inches towards the left heel of the man next on the right.

FIRE.—Apply the fore-finger with force to the trigger, without lowering or turning the head, and remain in that position.

LOAD.—1st mo. Bring back the piece quickly and take the position of the second motion of the first time of LOAD, except that the right thumb, instead of being placed against the steel, seizes the head of the cock, with the fore-finger bent, and the other fingers closed.

2d mo. Half-cock, carry the right hand immediately to the cartridge-box, passing it between the butt and the body, and open the box.

FIG. 7.

FIG. 8.

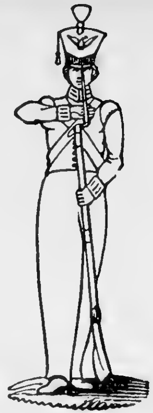


FIG. 9.

FIG. 10.

FIG. 11.

FIG. 12.

MANUAL OF INSTRUCTION

FOR THE

VOLUNTEERS AND MILITIA

OF THE

CONFEDERATE STATES.

BY

WILLIAM GILHAM,

COLONEL OF VOLUNTEERS, INSTRUCTOR OF TACTICS, AND COMMANDANT OF CADETS, VIRGINIA MILITARY INSTITUTE.

RICHMOND, VA.
WEST & JOHNSTON,
145 MAIN STREET.
1861.

Shoulder—ARMS.

One time and two motions.

105. *First motion.* Face to the front by turning on the left heel, bring up the right by the side of the left heel; at the same time bring up the piece with the right hand to the left shoulder, and place the left hand under the but.

Second motion. Let the right hand fall promptly into its position.

Load in ten times.

1. LOAD.

One time and two motions.

106. *First motion.* Drop the piece by a smart extension of the left arm, seize it with the right hand above and near the lower band; at the same time carry the right foot forward, the heel against the hollow of the left foot.

Second motion. Drop the piece with the right hand along the left thigh, seize it with the left hand above the right, and with the left hand let it descend to the ground without shock, the piece touching the left thigh and the muzzle opposite the centre of the body; carry the right hand quickly to the cartridge-box, and open it. (Fig. 32.)

2. *Handle*—CARTRIDGE.

One time and one motion.

107. Seize the cartridge with the thumb and the next two fingers, and place it between the teeth.

3. *Tear*—CARTRIDGE.

One time and one motion.

108. Tear the paper down to the powder, hold the cartridge upright between the thumb and two next fingers, near the top; in this position, place it in front of and near the muzzle, the back of the hand to the front.

4. *Charge*—CARTRIDGE.

109. Fix the eye on the muzzle, turn quickly the back of the right hand toward the body, in order to discharge the powder into the barrel,

raise the elbow to the height of the wrist, shake the cartridge, force it into the muzzle, and leave the hand reversed, the fingers closed but not clenched. (Fig. 33.)

5. *Draw*—Rammer.

One time and three motions.

110. *First motion.* Drop the right elbow smartly, and seize the rammer between the thumb and forefinger bent, the other fingers shut; draw it smartly, extending the arm, seize the rammer again at the middle between the thumb and forefinger, the hand reversed, the palm to the front, the nails up, the eyes following the movement of the hand; clear the rammer from the pipes by again extending the arm.

Second motion. Turn rapidly the rammer between the bayonet and the face, closing the fingers, the rammers of the rear rank grazing the right shoulders of the men of the same file in front, the rammer parallel to the bayonet, the arm extended, the but of the rammer opposite to the muzzle but not yet inserted, the eyes fixed on the muzzle.

Third motion. Insert the but of the rammer, and force it down as low as the hand.

6. *Ram*—Cartridge.

One time and one motion.

111. Extend the arm to its full length to seize the rammer between the right thumb extended and the forefinger bent, the other fingers closed; with force ram home twice, and seize the rammer at the small end between the thumb and forefinger bent, the other fingers closed, the right elbow touching the body.

7. *Return*—Rammer.

One time and three motions.

112. *First motion.* Draw the rammer briskly, reseize it at the middle between the thumb and forefinger, the hand reversed, the palm to the front, the nails up, the eyes following the hand; clear the rammer from the barrel by extending the arm.

Second motion. Turn the rammer rapidly between the bayonet and the face, closing the fingers, the rammers of the rear rank grazing the right shoulders of the men in the same file in front, the rammer parallel to the bayonet, the arm extended, the little end of the rammer opposite to the first pipe but not yet inserted, the eyes fixed on that pipe.

Third motion. Insert the small end, and with the thumb, which will follow the movement, force it as low as the middle band; raise the hand quickly, a little bent, place the little finger on the but of the rammer and force it down; lower the left hand on the barrel to the extent of the arm without depressing the shoulder.

8. *Cast*—About.

One time and two motions.

113. *First motion.* With the left hand bring up the piece vertically against the left shoulder, seize it smartly with the right hand at the small of the stock, and slide the left hand down as low as the chin.

Second motion. Make a half-face to the right on the left heel, bring the left toe to the front, place the right foot at the same time close behind, and at right angles with the left, the hollow of the right foot against the left heel; carry the piece opposite to the right shoulder; bring down the piece with the right hand into the left, with which seize it at the tail-band, the thumb extended on the stock, the but under the right forearm, the small of the stock against the body and about two inches under the right breast, the muzzle at the height of the eye, the left elbow supported against the side, the right hand grasping the small of the stock. (Fig. 34.)

9. Prime.

One time and one motion.

114. Place the thumb of the right hand on the hammer (the fingers remaining under and against the guard) and half-cock the piece; brush off the old cap, and with the thumb and first two fingers of the right hand take a cap from the pouch, place it firmly on the cone by pushing it down with the thumb, and seize the piece by the small of the stock.

10. *Shoulder*—Arms.

One time and two motions.

115. *First motion.* Face to the front by turning on the left heel; at the same time bring the piece briskly with the right hand to the left shoulder and place the left hand under the but.

Second motion. Let the right hand fall smartly into its position.

Ready. (From the position of *prime.*)

One time and one motion.

116. Place the thumb of the right hand on the hammer (the fingers remaining under and against the guard), cock the piece, and seize the small of the stock.

Ready. (From the position of *shoulder arms.*)

One time and four motions.

117. *First motion.* Turn the piece with the left hand, the lock to the front, seize it at the small of the stock with the right hand, at the same time make a half-face to the right on the left heel, bringing the left toe to the front, and placing the right foot behind and at right angles to the left, the hollow of the foot against the left heel.

Second motion. Bring the piece with the right hand to the middle of the body, place the left hand just above the lock, the thumb extended along the stock at the height of the chin, the counter (or S) plate turned toward the body, the rammer obliquely to the left and front.

Third motion. Place the thumb on the hammer, the forefinger under and on the guard, the other three fingers joined to the first, the elbow at the height of the hand.

Fourth motion. Close the right elbow smartly to the body in cocking, without bending the wrist, seize the piece by the small of the stock, let it descend along the body in the left hand to the tail-band, which will remain at the height of the shoulder. (Fig. 35.)

Aim.

One time and one motion.

118. Raise the but to the shoulder, the left elbow a little down, shut the left eye, direct the right along the barrel, drop the head upon the but to catch the object, and place the forefinger on the trigger. The rear rank will at the same time carry the right foot about eight inches toward the left heel of the man next on his right. (Fig. 36.)

Fire.

One time and one motion.

119. Apply the forefinger with force to the trigger without further lowering or turning the head, and remain in that position.

Load. (From the *Fire.*)

One time and two motions.

120. *First motion.* Bring back the piece quickly with both hands, depress the but strongly by extending the right arm, and carry it with the arm thus extended to the left side, the barrel to the front and opposite to the left shoulder, the left hand at the height of the chin, the back of the hand to the front, the left forearm touching the stock; at the same time face to the front and carry the right foot forward, the heel against the hollow of the left foot.

Second motion. Let go the handle with the right hand, let the piece descend through the left to the ground without shock, and take the position of the second motion of *load.*

Shoulder—Arms. (From the *Fire.*)

One time and two motions.

121. *First motion.* Bring back the piece with both hands, face to the front, carry the piece against the left shoulder, and place the left hand under the but.

Second motion. Let the right hand fall smartly to its position.

The squad being in the position of *aim*, the instructor, to habituate the soldiers to wait for the word *fire*, sometimes commands:

Recover—Arms.

One time and one motion.

122. Withdraw the finger from the trigger, throw up the muzzle smartly, and retake the position of the fourth motion of *ready.*

The men being in this position, if the instructor wishes them to come to a shoulder he commands:

Shoulder—Arms.

123. At the word *shoulder*, the squad will face to the front and bring their pieces to the middle of the body again; the left thumb at the height of the chin, the little finger just above the lock; next place the right thumb on the head of the hammer, support the forefinger on the trigger, sustain the hammer carefully in its descent at the same time to the position of half-cock, then seize the small of the stock with the right hand. At the word *arms*, carry the piece to the shoulder smartly and take the position of *shoulder arms.*

To load in four times (or *pauses*).

124. The instructor commands:

1. *Load in four* TIMES. 2. LOAD.

Execute the first time of loading, handle cartridge, tear cartridge, charge cartridge.

TWO.

125. Draw rammer, enter it as far as the hand, and ram twice.

THREE.

126. Return rammer, cast about, and prime.

FOUR.

127. Execute the tenth time of loading.

128. The soldiers being at a shoulder, when the instructor may wish to return bayonets he commands:

Unfix—BAYONET.

One time and three motions.

First motion. Drop the piece by a smart extension of the left arm, seize it with the right hand above and near the tail-band.

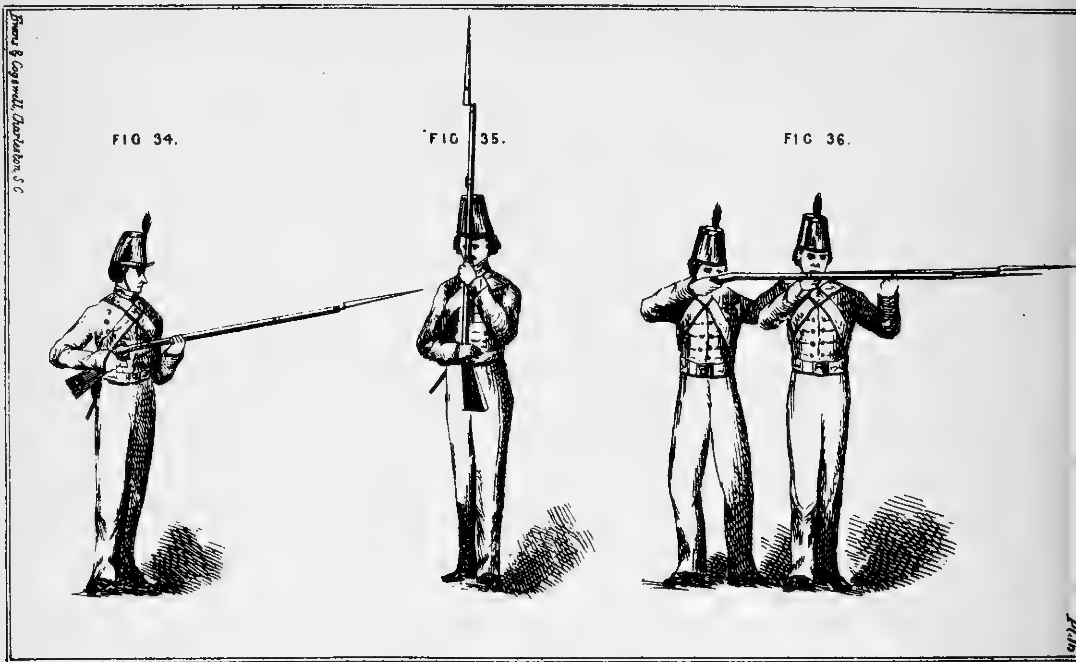
Second motion. Drop the piece with the right hand along the left thigh, seize it with the left hand above the right, lengthen out the left arm, rest the but on the ground without shock, and carry the right hand at the same time to the bayonet, with the thumb lower the clasp against the stop, and then seize the bayonet at the socket and shank.

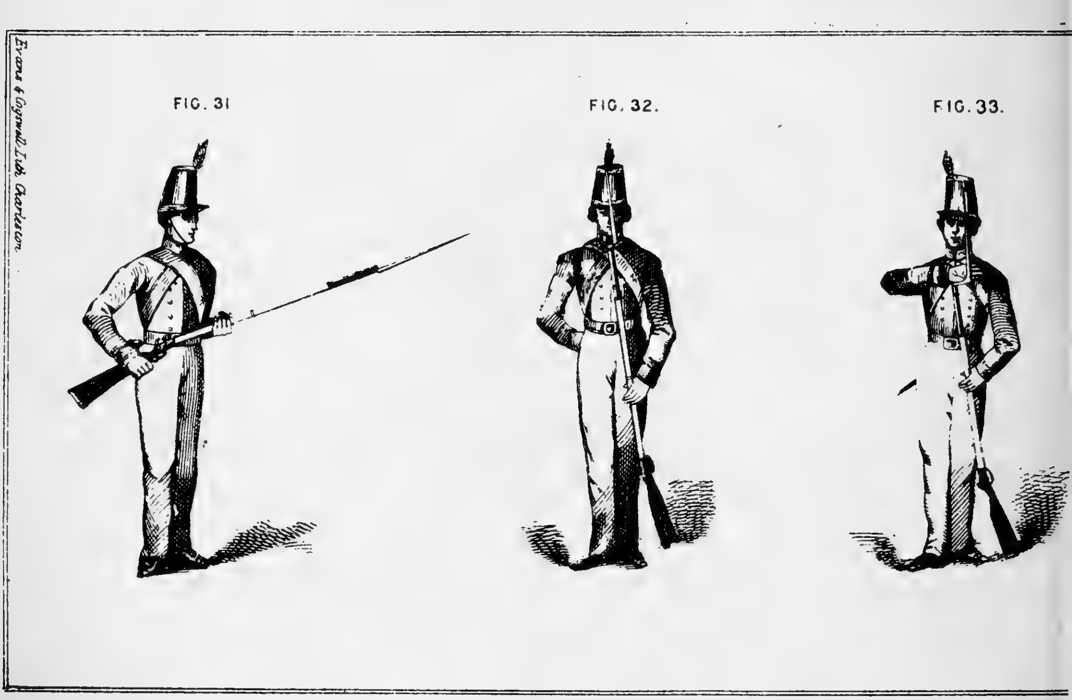
Third motion. Wrest off the bayonet, return it to the scabbard, place the little finger on the but of the rammer, lower the left hand along the barrel in extending the arm, without depressing the shoulder.

Shoulder—ARMS.

One time and three motions.

129. *First motion.* Raise the piece with the left hand along the left side, the hand at the height of the chin, the forearm touching the piece, the barrel to the front; drop at the same time the right hand to seize the piece a little above the handle, the forefinger touching the cock and the thumb on the counter-plate.


Evans & Cogswell, Charleston, S.C.
FIG 34.
FIG 35.
FIG 36.


Evans & Cogswell Lith. Charleston
FIG. 31
FIG. 32.
FIG. 33.

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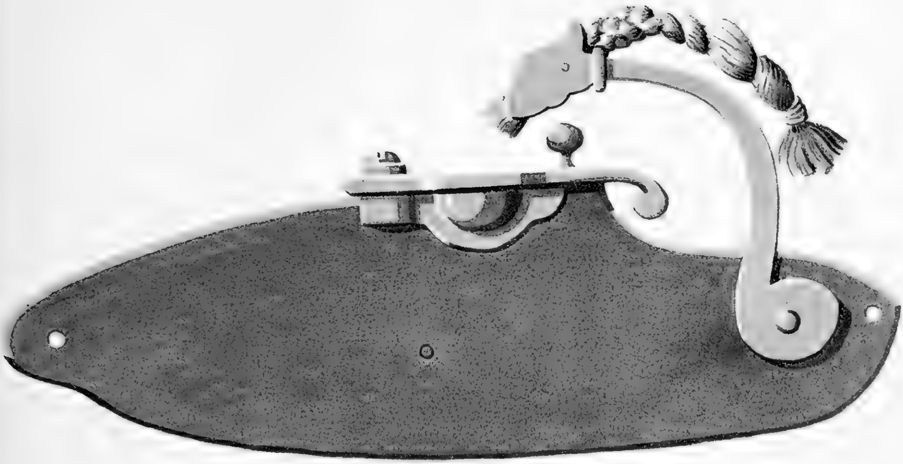


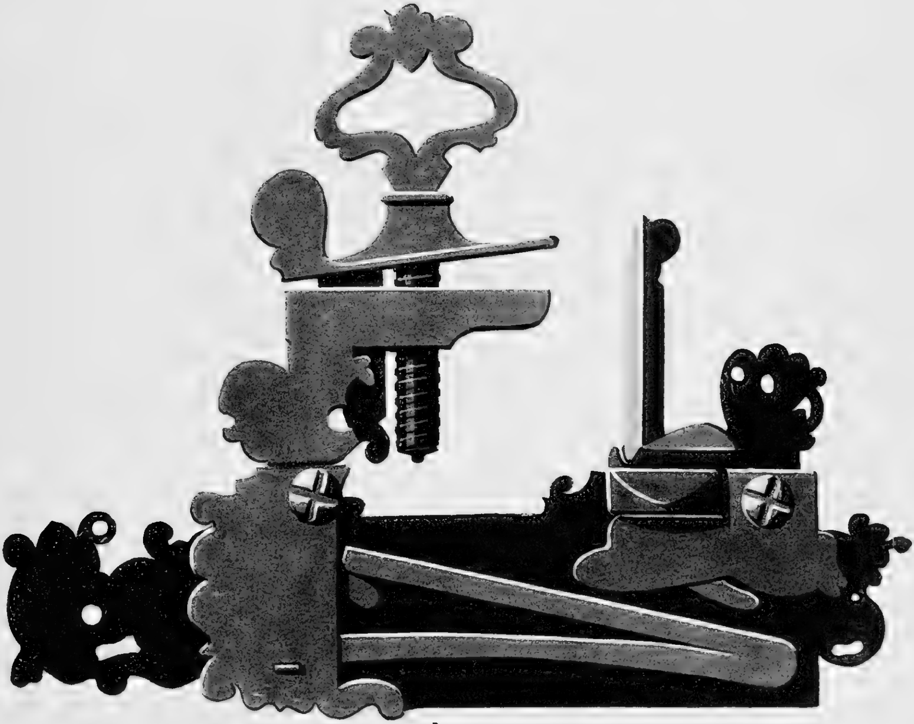
a

b

Plate I.—Colonial firearms: *a,* Matchlock; *b,* wheel-lock.

Plate 2.—A MUSKETEER.

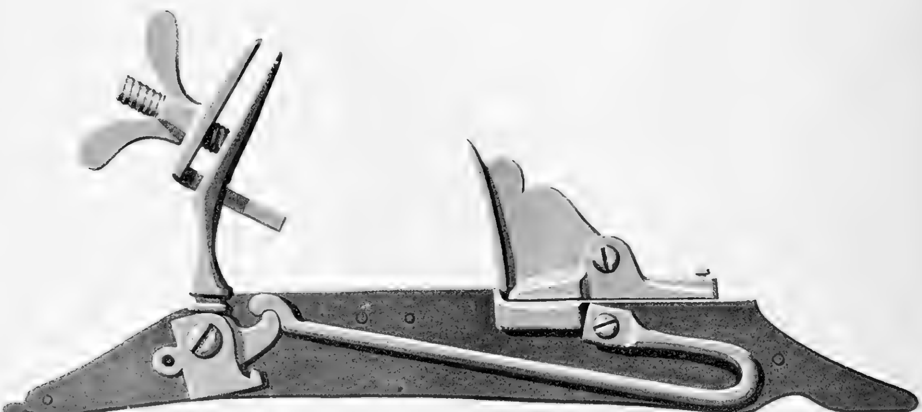
a



b

Plate 3.—Colonial firearms: *a*, Snaphaunce lock; *b*, miquelet lock.

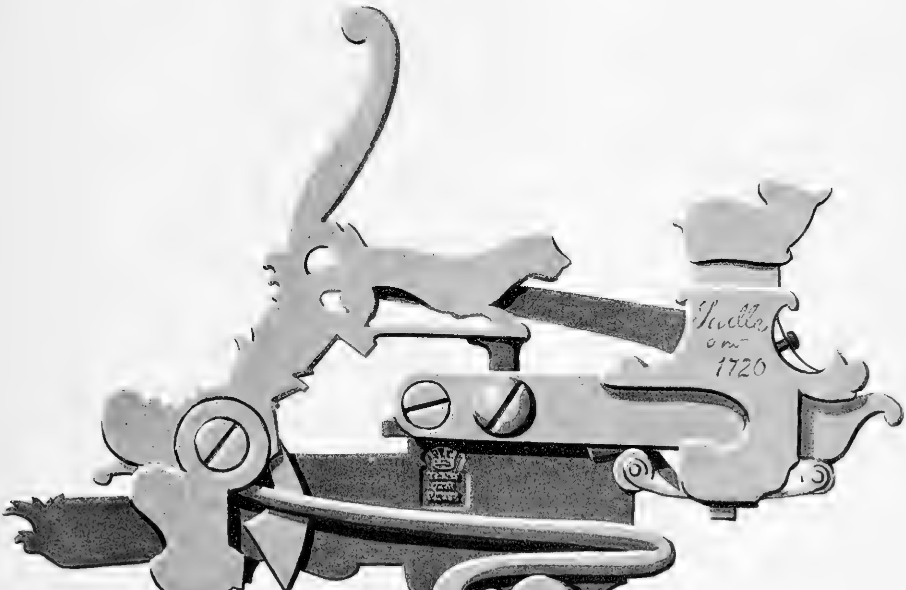
a



b

Plate 4.—Colonial firearms: *a,* Flint "dog" lock; *b,* Baltic lock.

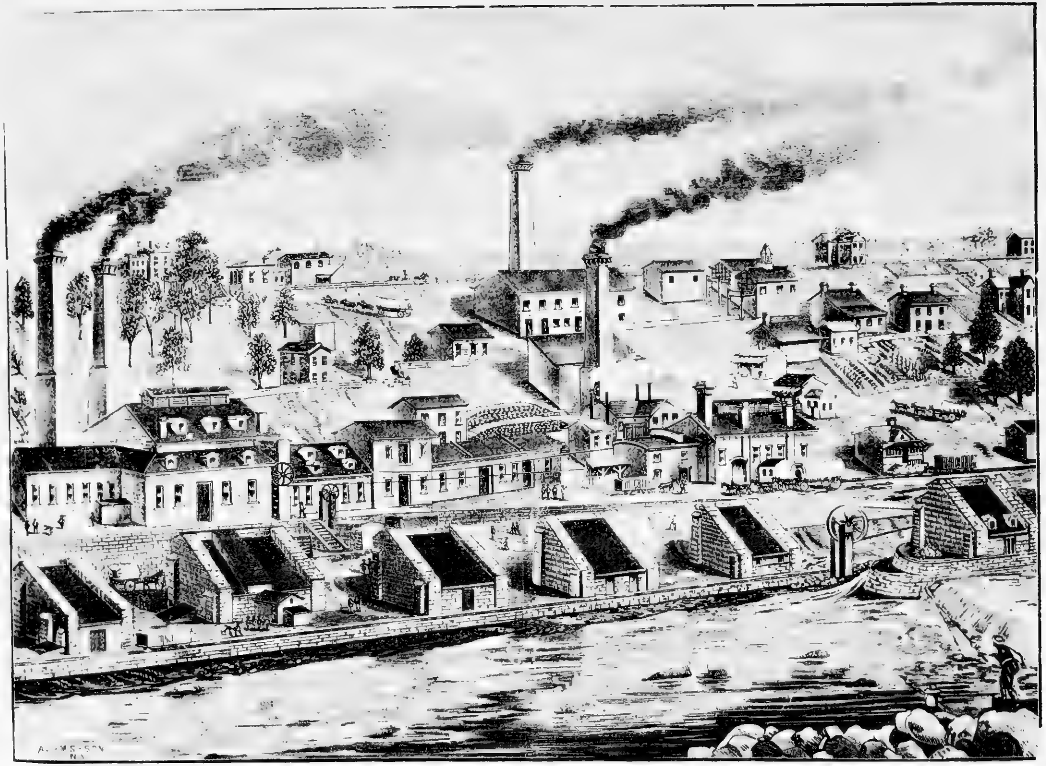
a



b

Plate 5.—TRANSITION IGNITION TYPES: *a,* Flintlock; *b,* magazine percussion lock.

Plate 6.—First powder mill of E. I. Du Pont de Nemours & Co., on the Brandywine near Wilmington, Del. (Courtesy Du Pont Co.)



VIEW OF MESSRS. DU PONT DE NEMOURS & CO'S UPPER BRANDYWINE GUN POWDER MILLS, NEAR WILMINGTON, DELAWARE, U. S. A.

Plate 7.—THE DU PONT BRANDYWINE POWDER MILLS in the 1850's. (Courtesy Du Pont Co.)

Plate 8.—FIVE CAN FLASKS of sporting-type powder. (J. M. Standish collection.)

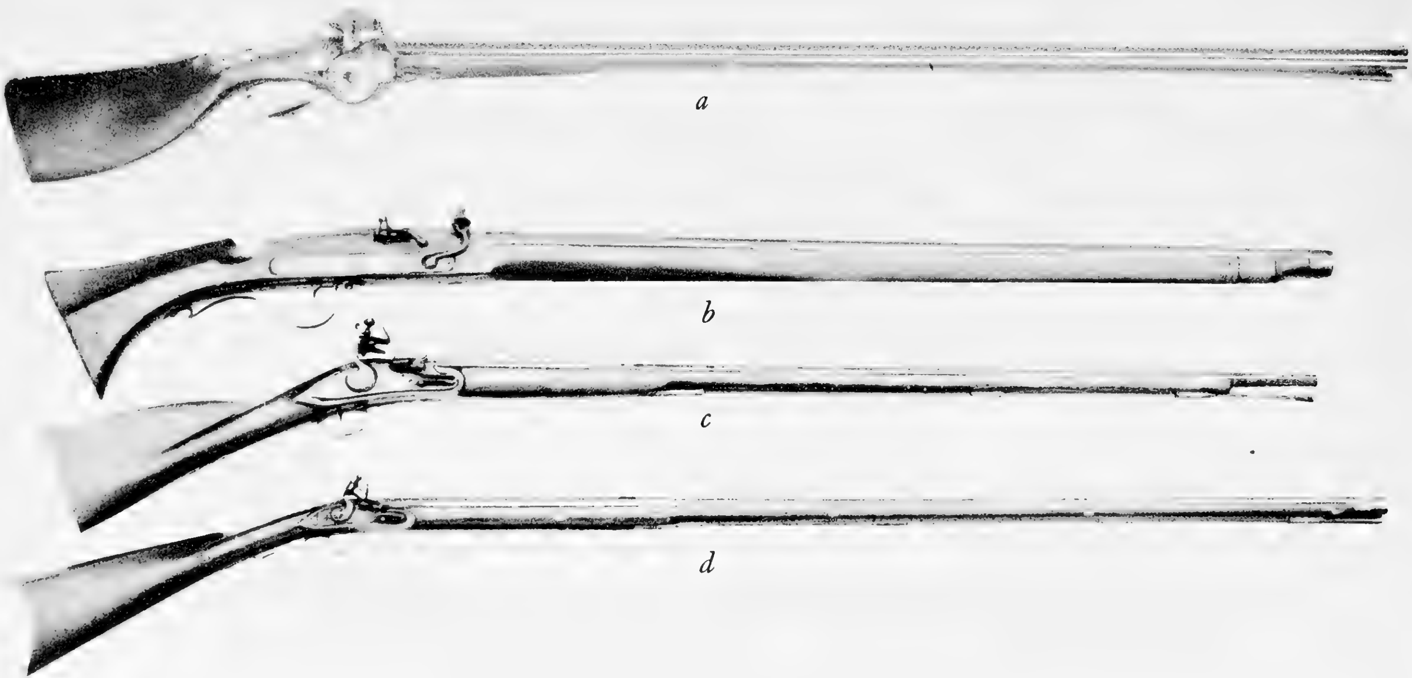


Plate 9.—Early types of shoulder weapons used in America: *a*, Wheel-lock musket, caliber 0.60, Colonial period; *b*, match-lock musket, caliber 0.80, Colonial; *c*, French musket, about 1700, used in French and Indian and Revolutionary Wars; *d*, flintlock, caliber 0.50, formerly rifled, now smooth-bore, 1780-1800.

Plate 10.—UNITED STATES MUSKETS: *a*, Contract, caliber 0.70, 1780-1795; *b*, Springfield, model 1795 caliber 0.69; *c*, Springfield model 1822, caliber 0.69; *d*, Springfield, model 1840, caliber 0.69; *e*, Springfield, model 1842, percussion, caliber 0.69.

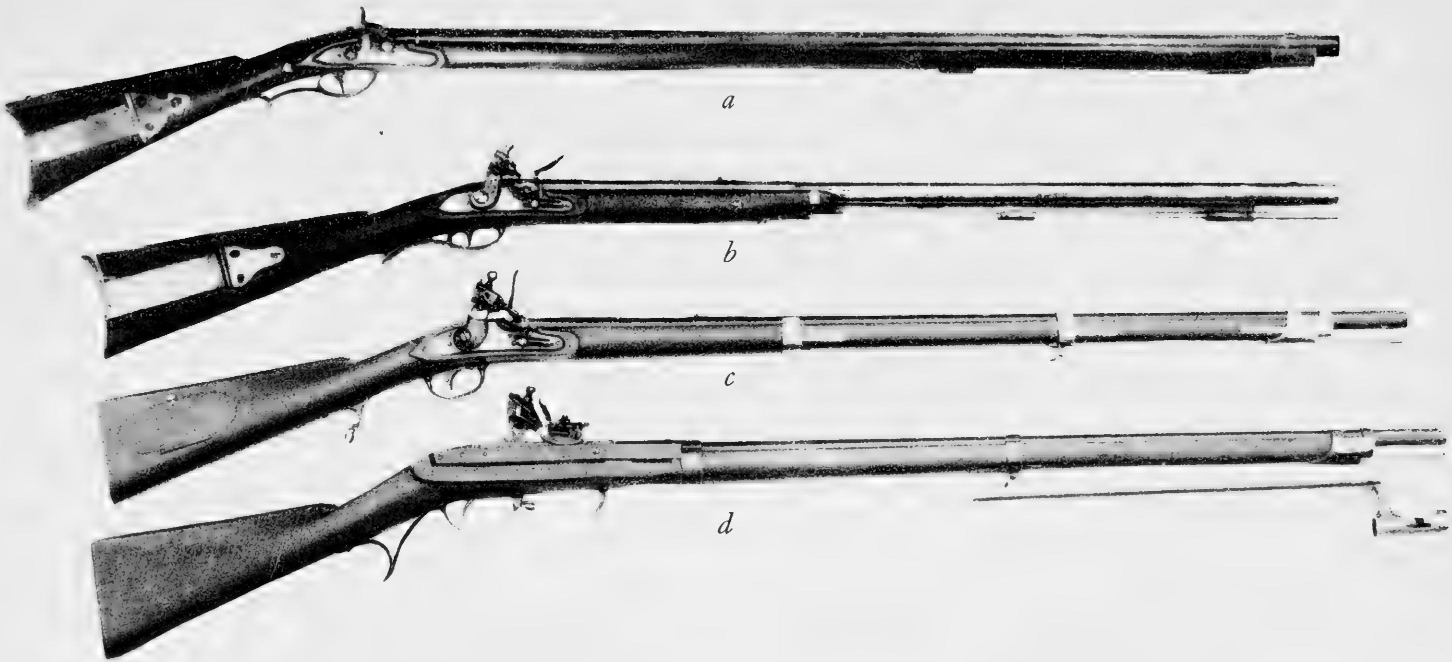


Plate 11.—United States flintlock rifles: *a,* Contract, caliber, 0.52, by P. Gonter, 1792 (collection of C. J. Langer), altered to percussion; *b,* Harpers Ferry, model 1804, caliber 0.54; *c,* contract, model 1819, caliber 0.54, by Johnson; *d,* Hall's, model 1819, caliber 0.52 made at Harpers Ferry.

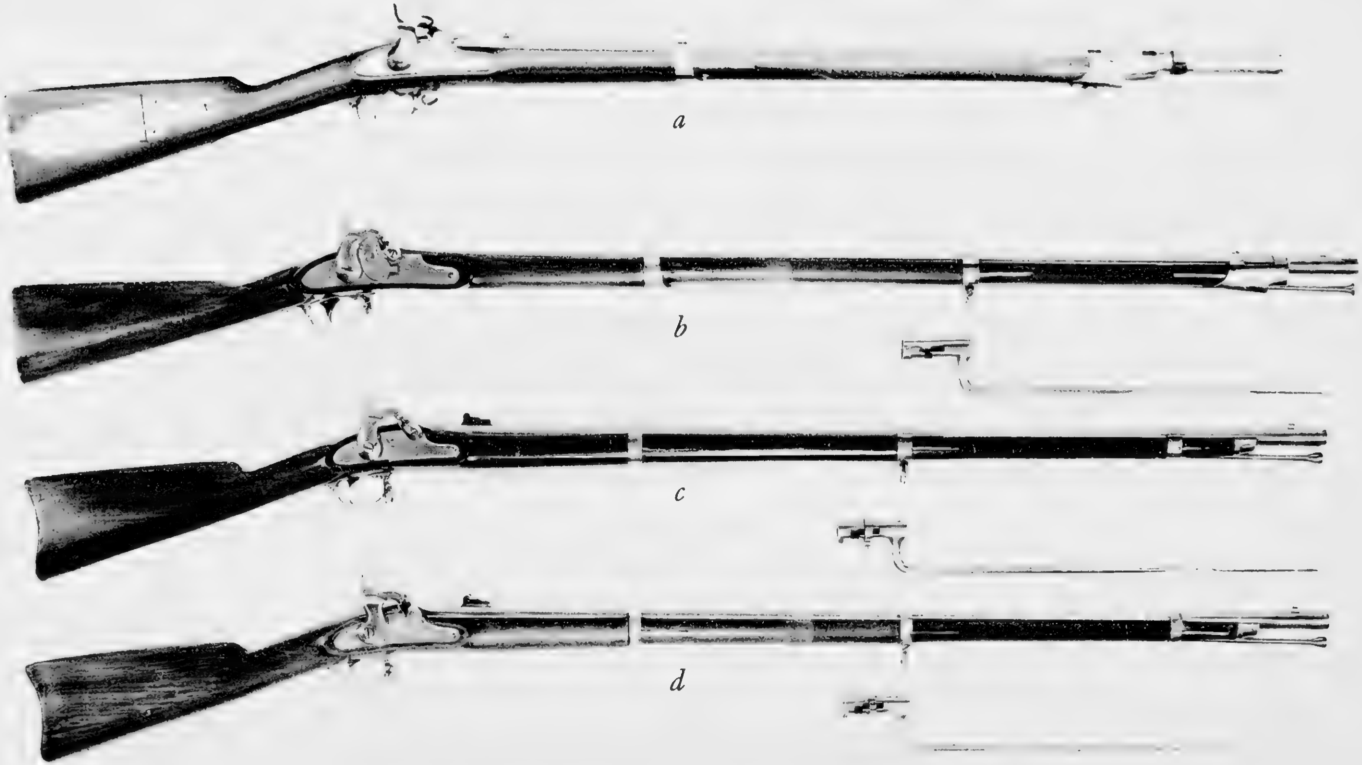


Plate 12.—UNITED STATES PERCUSSION RIFLES: *a*, Harpers Ferry, model 1841, caliber 0.54; *b*, Springfield rifle-musket, model 1855, caliber 0.58; *c*, Springfield, model 1861, caliber 0.58; *d*, Springfield, model 1863, caliber 0.58.

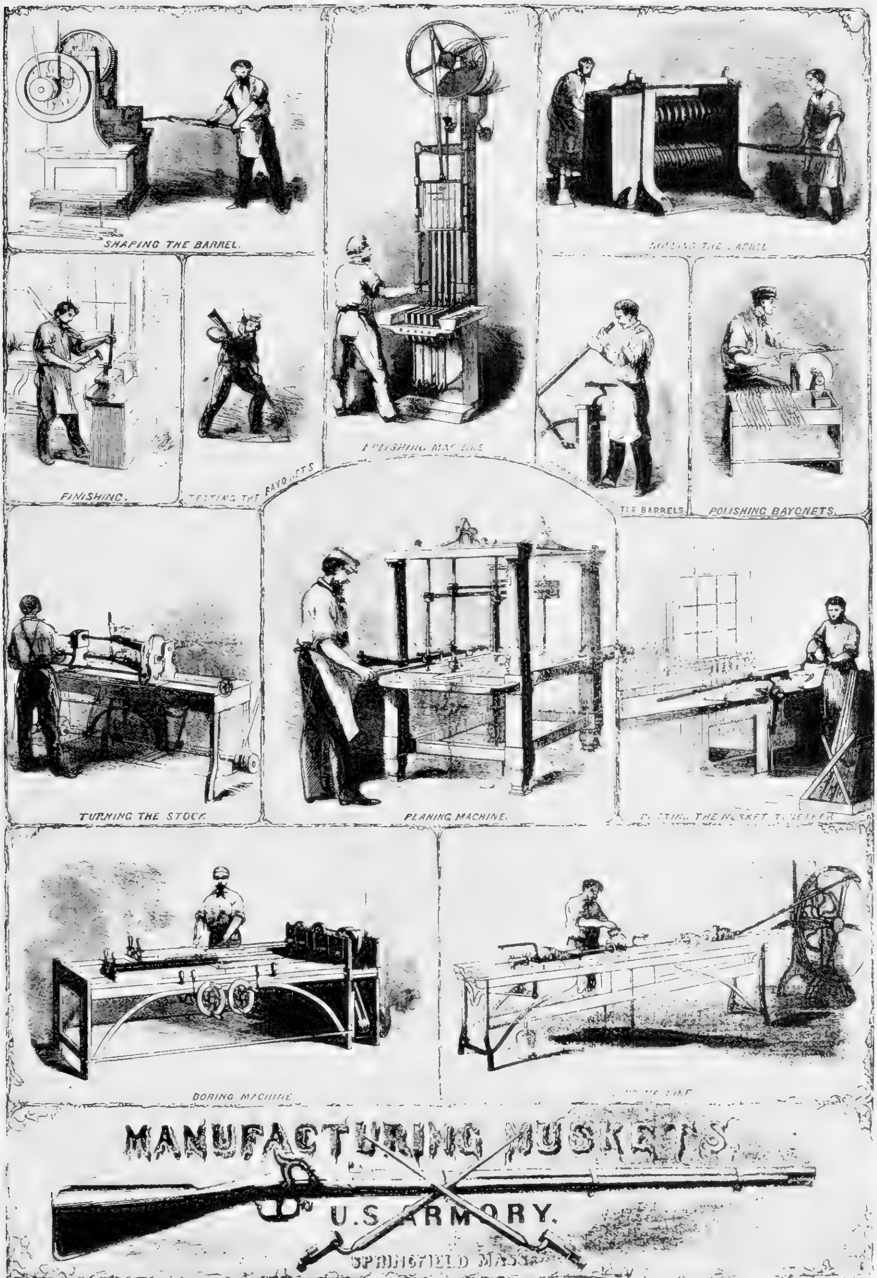


Plate 13.—Musket manufacture at Springfield Armory. (Harpers Weekly, September 21, 1861.)

Plate 14.—UNITED STATES SINGLE-SHOT PISTOLS: *a,* Contract, model 1808, caliber 0.69, by North; *b.* Harpers Ferry, model 1806, caliber 0.54; *c,* contract, model 1808, caliber 0.54, by Henry; *d,* contract, model 1816, caliber 0.54, by North; *e,* Springfield, model 1818, caliber 0.69 (H. M. Stewart coll.); *f,* contract, model 1819, caliber 0.54, by North; *g,* contract, model 1836, caliber 0.54, by Johnson; *h,* contract, model 1842, caliber 0.54, by Aston; *i,* contract, model 1843, caliber 0.54, by Ames; *j,* Springfield pistol-carbine, model 1855, caliber 0.58.

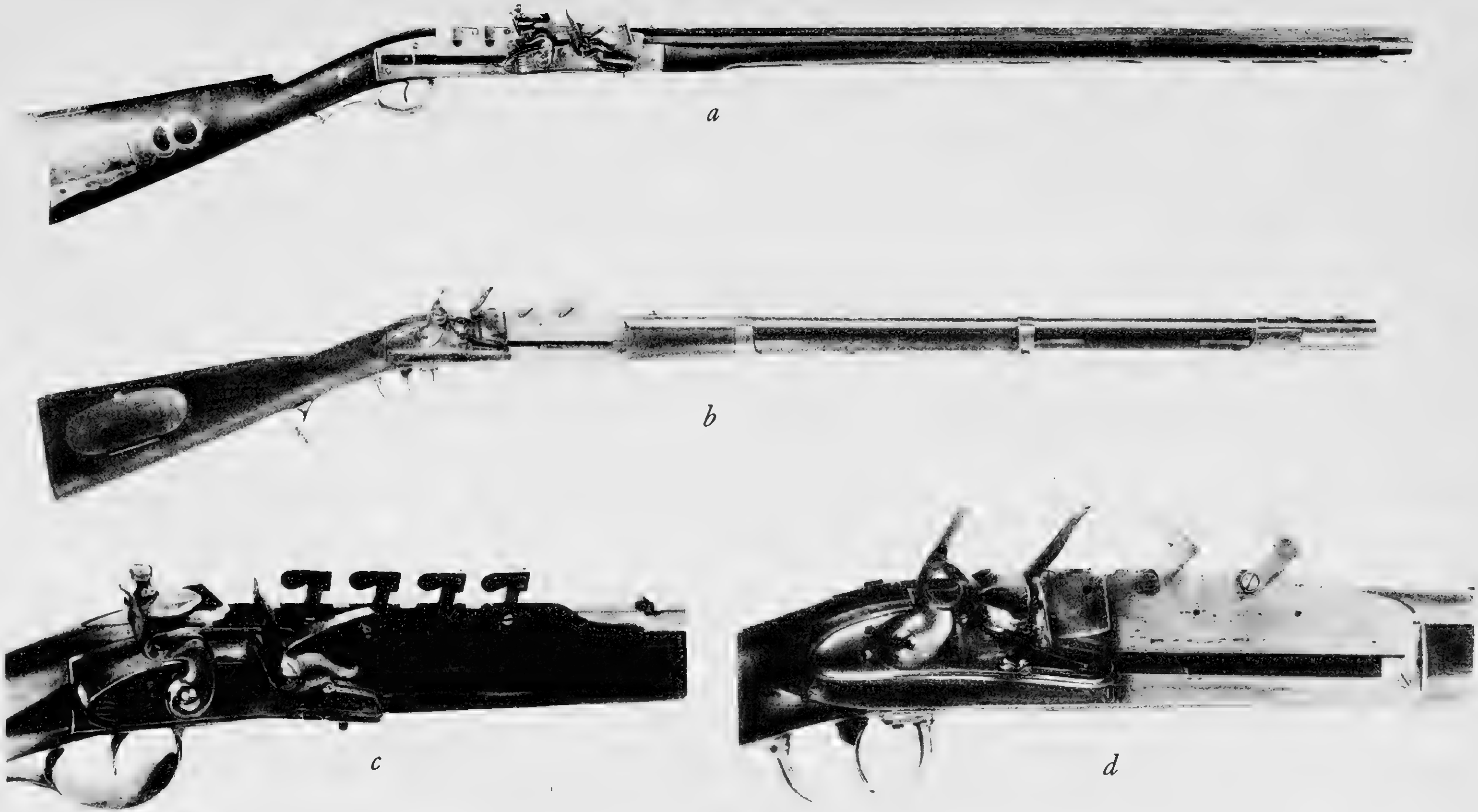


Plate 15.—Multishot rifles: *a*, Chambers, caliber 0.54; *b*, Ellis-Jennings, caliber 0.54 (Springfield Armory Museum); *c*, detail of Chambers lock; *d*, detail of Ellis lock.

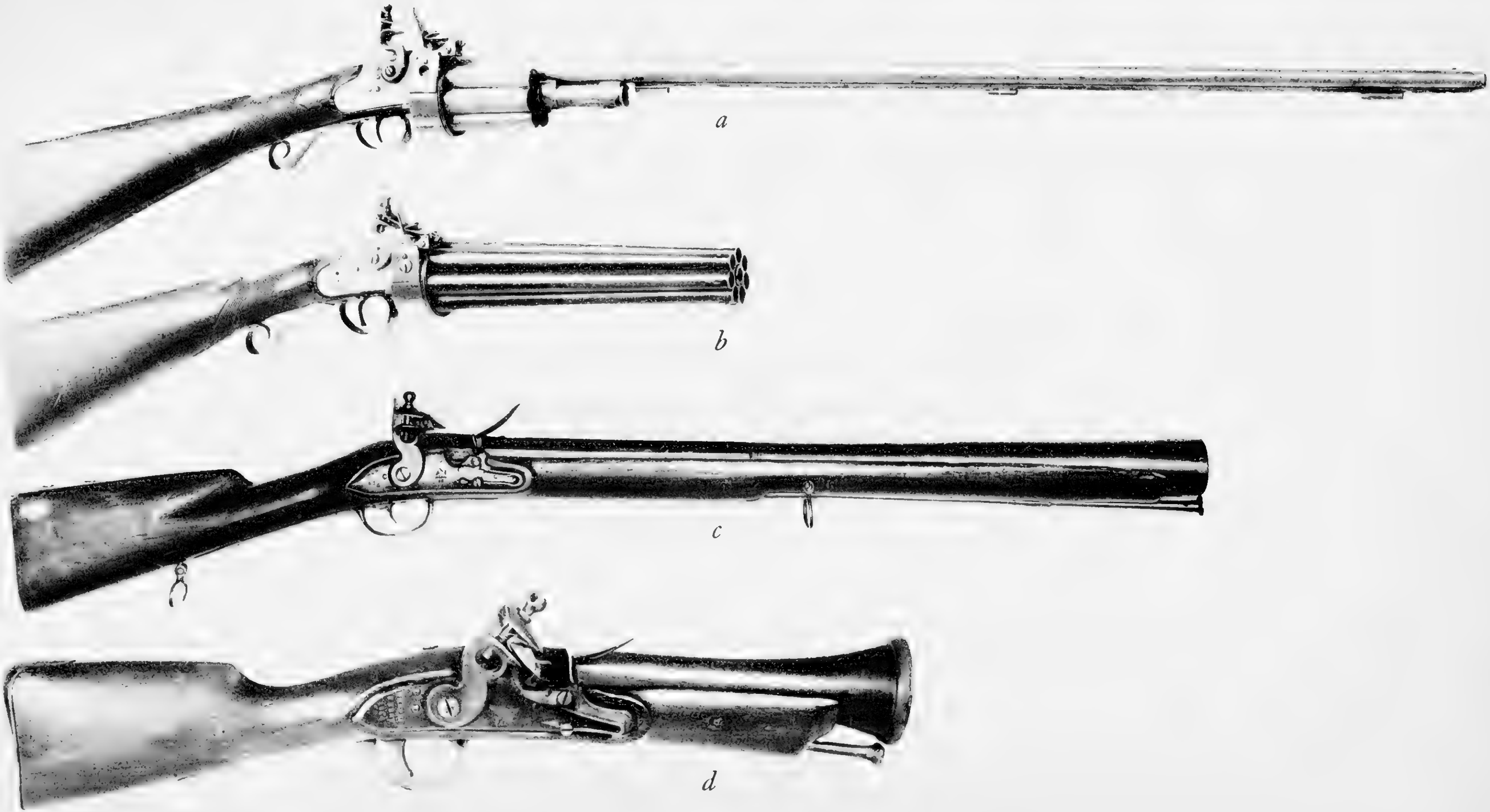


Plate 16.—Repeating musket and blunderbusses: *a*, Wheeler cylinder musket (U. S. Nat. Mus. coll.); *b*, Wheeler cylinder carbine (U. S. Nat. Mus. coll.); *c*, Harpers Ferry blunderbuss (Fuller coll.); *d*, Harpers Ferry hand blunderbuss (the frizzen spring is not the original).

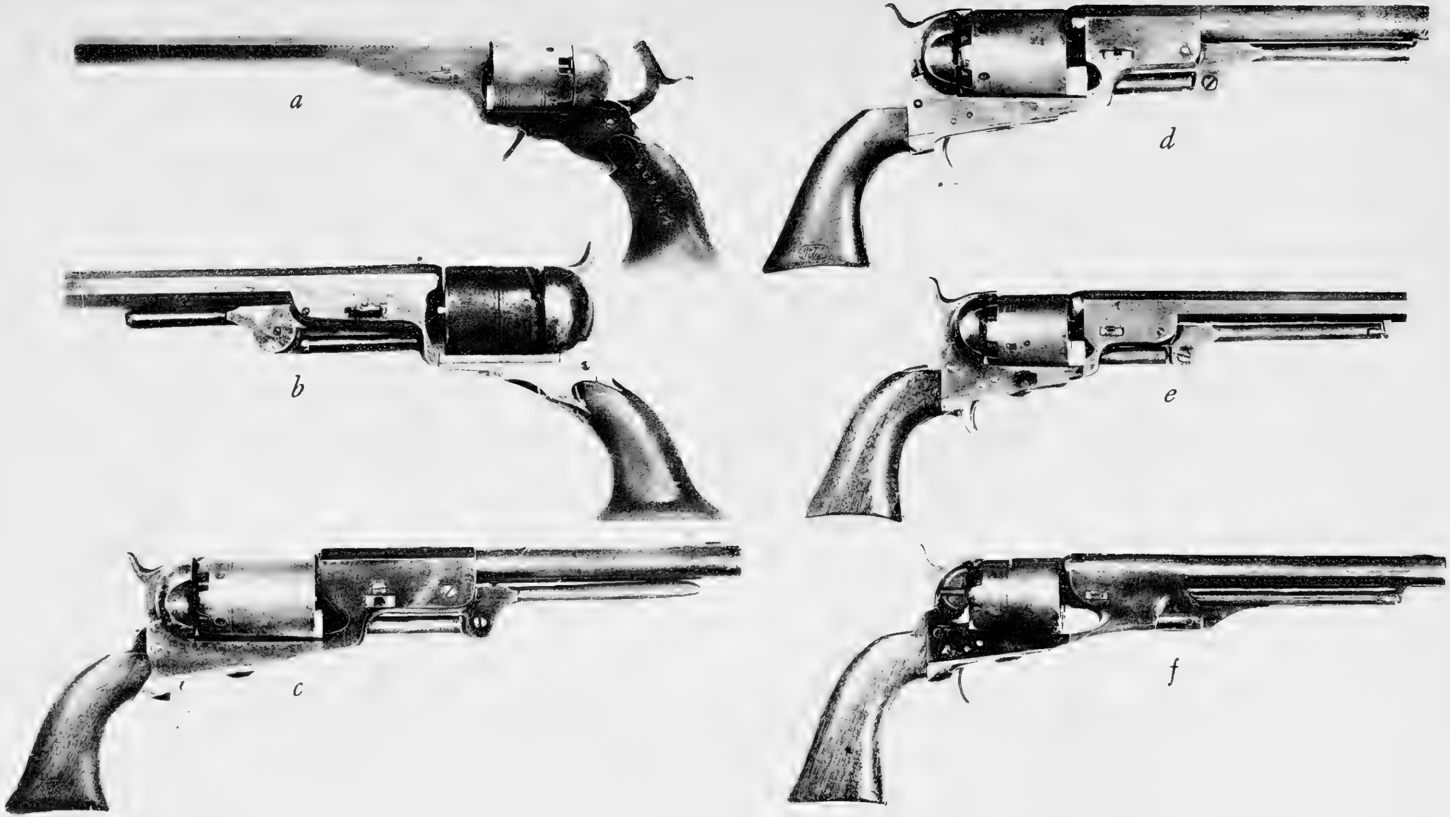


Plate 17.—United States Colt revolvers: *a*, "Texas" model, 1838, caliber 0.34 (U. S. Nat. Mus. coll.); *b*, holster-size, 1839-41, caliber 0.52 (H. M. Stewart coll.); *c*, "Whitneyville" Army model, 1847, caliber 0.44 (Stewart); *d*, Army or Dragoon model, 1848-61, caliber 0.44 (Stewart); *c*, Navy model, caliber 0.36, 1851-66 (Stewart); *f*, "New Army" model, 1861-66, caliber 0.44 (Stewart).

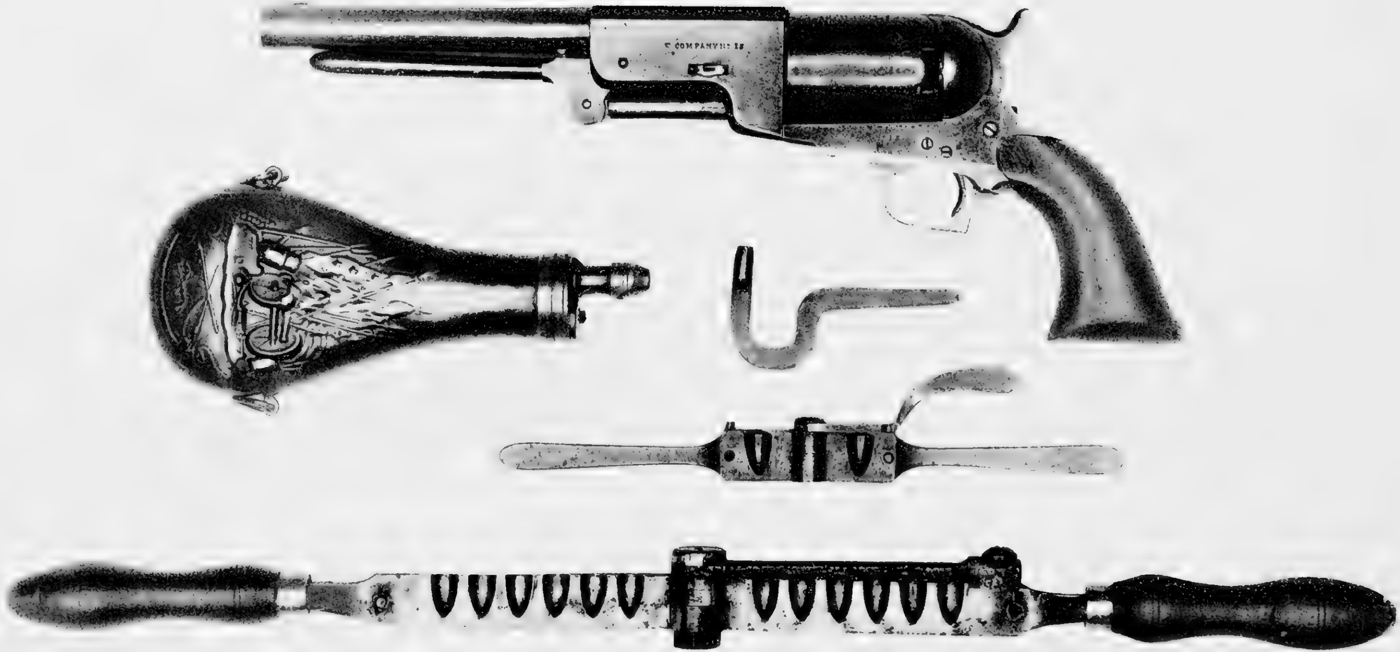


Plate 18.—WHITNEYVILLE-WALKER COLT REVOLVER, with issue accessories. (H. M. Stewart coll.)

Plate 19.—Service holsters for Walker-Colt revolvers: *a,* Example believed to be the first Walker type, with large stars on the caps; *b,* regulation for Walker revolver, model 1848 Dragoon revolver for comparison.

Plate 20—Accoutrements (half size except as noted): a, Brush and picker for flintlock musket (¼ size); *b*, screwdriver, scourer, and lead for flintlock rifle; *c*, scourers for muskets and model 1841 rifle; *d*, tompions for muskets and rifles; *e*, Civil War rifle tool set (worm, scourer, screwdriver-sight wrench, pin punch, screwdriver-nipple wrench, spring vice); *f*, bayonet adapter for model 1841 rifle.

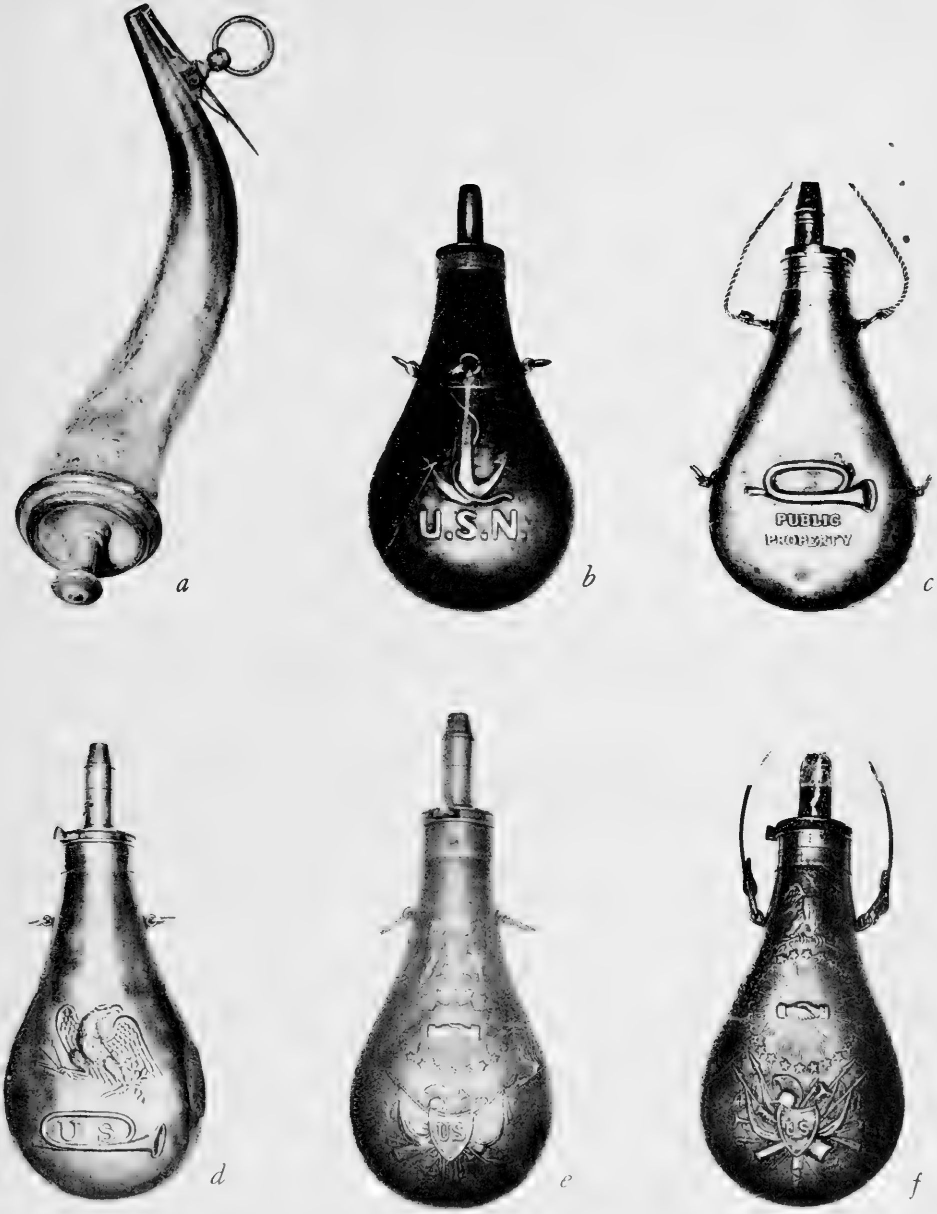


Plate 21.—United States rifle flasks and horn (0.4 size): *a,* Powder horn, Allegheny Arsenal, 1820-30; *b,* Navy copper flask for Jenks rifle, by Ames, 1846; *c,* undated brass flask, 1820-30; *d,* copper flask, by Dingee, 1832; *e,* copper flask, by Ames, 1846; *f,* copper flask, by Batty, 1853.

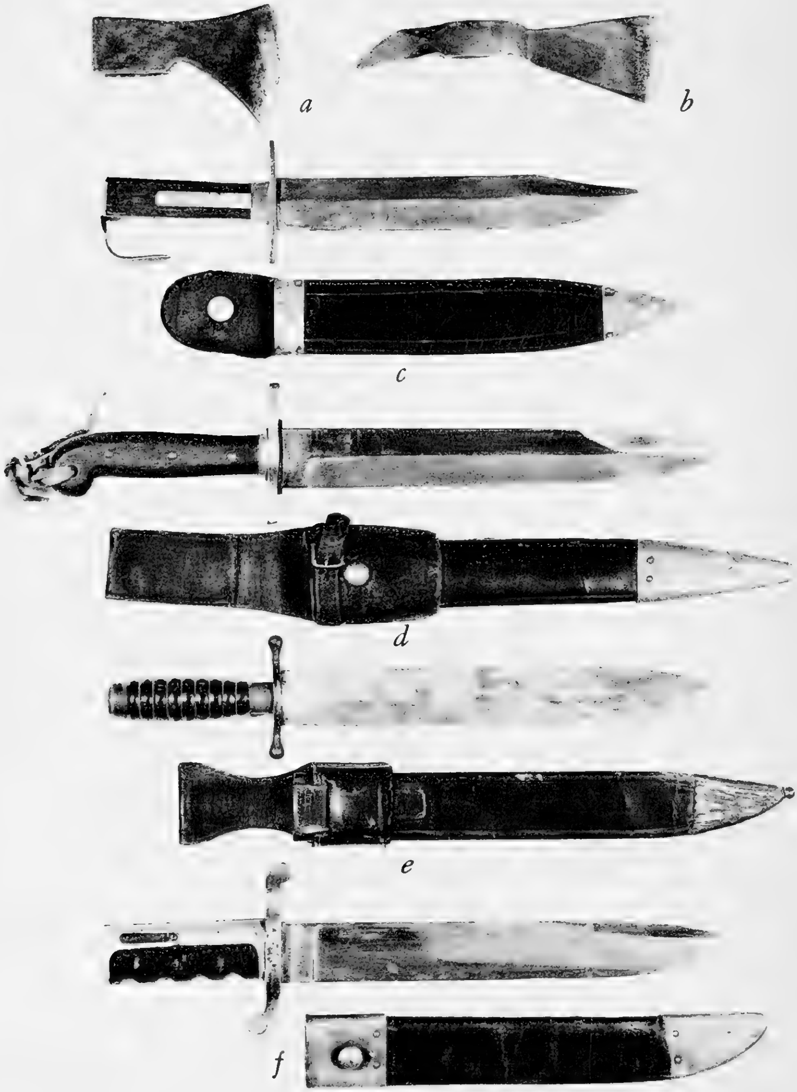


Plate 22.—Accoutrements: Tomahawks and knives: *a,* Military tomahawk, 18th-19th century; *b,* trade tomahawk, 18th century; *c,* A. G. Hicks rifleman's knife, 1830-40; *d,* N. P. Ames rifleman's knife, 1849; *e,* Collins rifleman's knife, 1850-60; *f,* Dahlgren bowie-bayonet, 1863.

Plate 23.—Cartridges for flintlock muskets: *a*, Ball, French type, 1780; *b*, ball, French type, 1812; *c*, ball, French type, 1820-30; *d*, blank, French type, 1812 (blue paper); *e*, round ball, caliber 0.64, used in *a*, *b*, and *c*; *f*, round ball, caliber 0.70, used in British musket; *g*, buckshot, British type, 1812-20; *h*, X-ray of *g*, showing 9 shot in 3 tiers *i*, buckshot, British type, 1780-1812; *j*, X-ray of *i*, showing 6 shot distributed through powder; *k*, blank, British type, 1812-20.

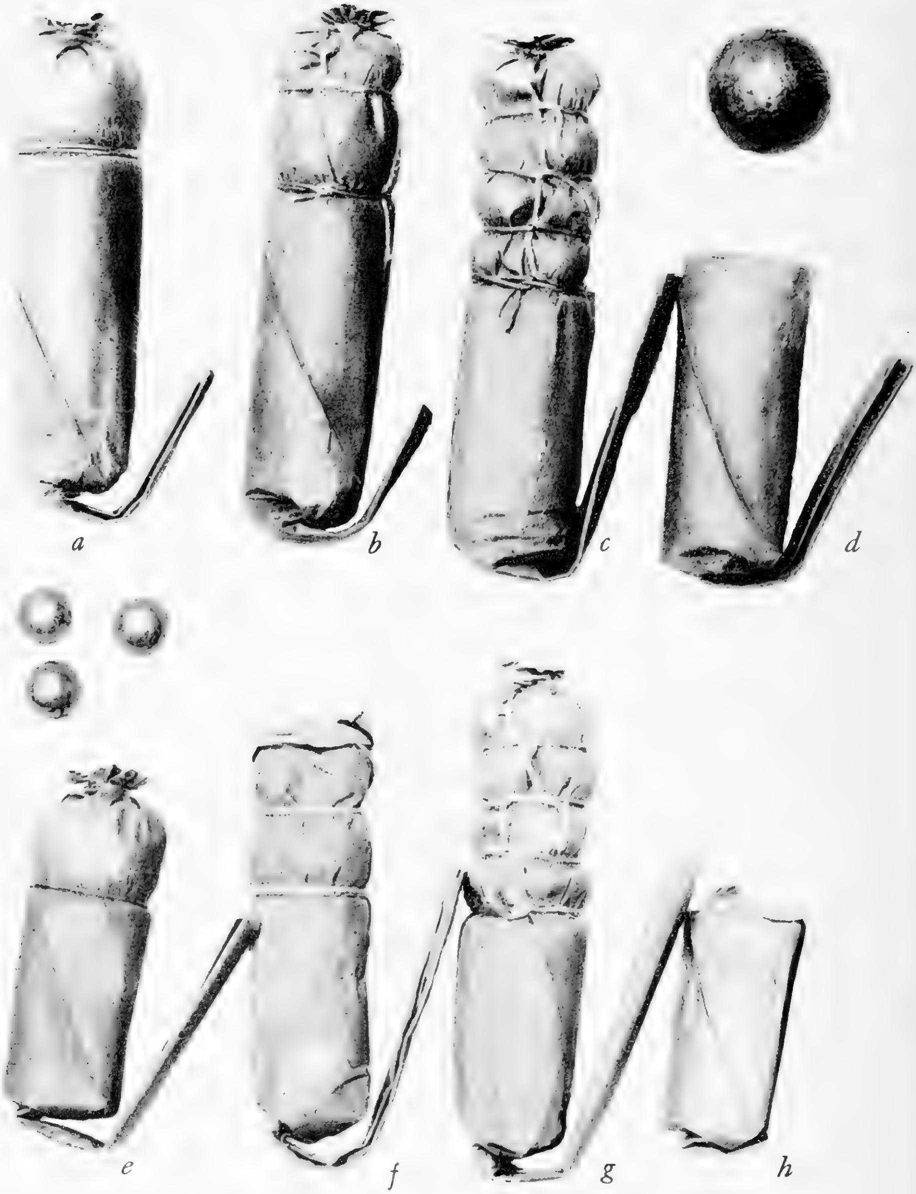


Plate 24.—Cartridges for flintlock muskets and musketoons, models 1822 and 1840, as of 1840: *a,* Ball, musket; *b,* buck and ball, musket; *c,* buckshot, musket; *d,* blank or exercise, musket; *e,* ball, musketoon; *f,* buck and ball, musketoon; *g,* buckshot, musketoon; *h,* blank, musketoon.

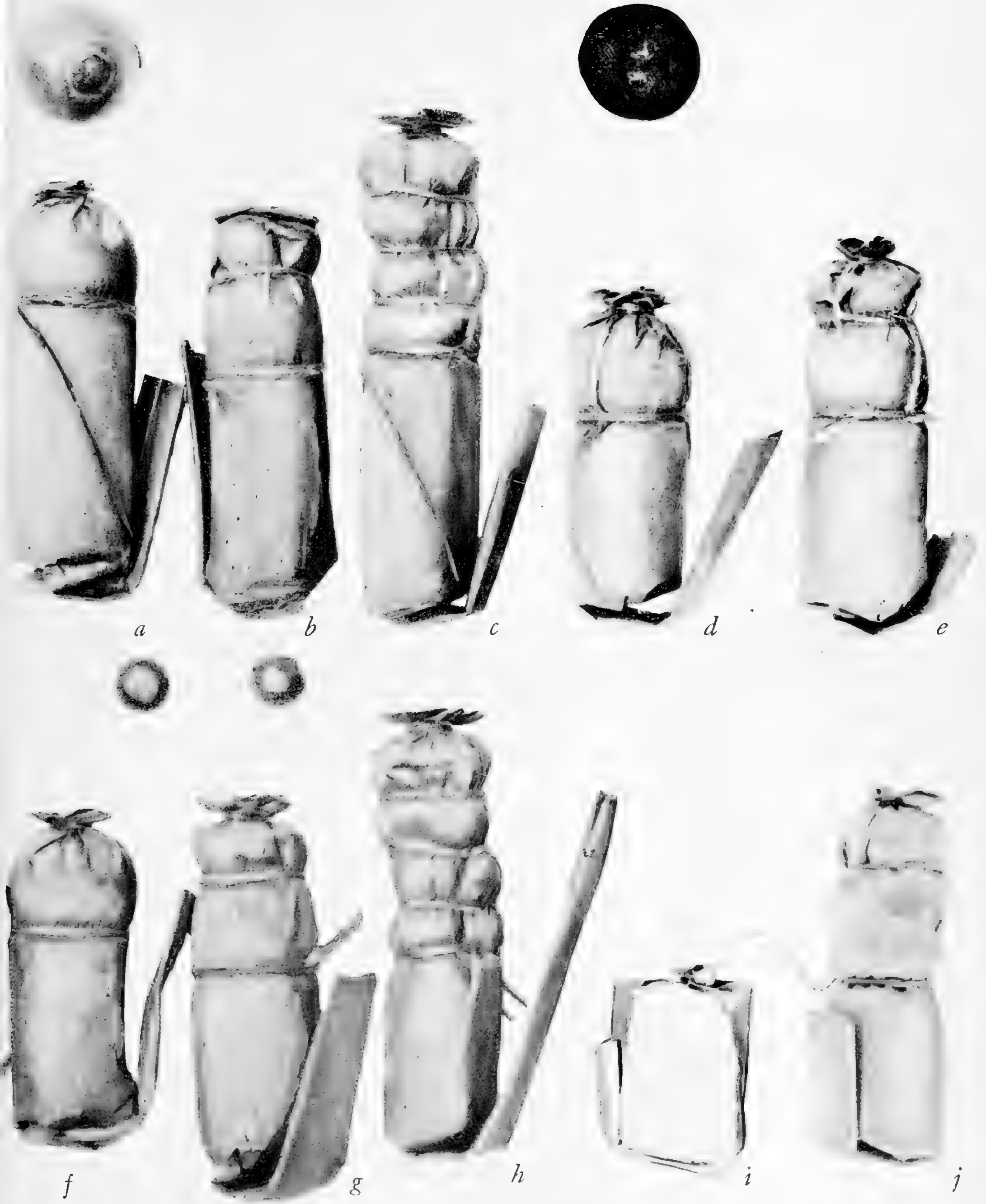


Plate 25.—Cartridges for percussion muskets, musketoon, and Hall's carbine of musket caliber (0.64): *a*. Ball, musket, model 1842 (1861 Ordnance Manual); *b*, buck and ball, same; *c*, buckshot, same; *d*, ball, Hall's carbine (1841 Ordnance Manual); *e*, buck and ball, same; *f*, ball, musketoon, model 1847 (1849 Ordnance Manual); *g*, buck and ball, same; *h*, buckshot, same; *i*, blank, musket, model 1842 (1861 Ordnance Manual); *j*, buckshot, musketoon (1861 Ordnance Manual).

Plate 26.—CARTRIDGES FOR RIFLED MUSKETS AND MUSKETOONS: *a,* Ball, rifled musket (1861 Ordnance Manual); *b,* buckshot, same; *c,* ball, rifled musketoon (1861 Ordnance Manual); *d,* conical bullet with wooden plug used in *a; e,* later bullet, no plug, 725 grains; *f,* Mefford subcaliber, ball; *g,* Mefford subcaliber, buck and ball; *h,* Mefford projectile, with wooden sabot; *i,* ball, rifled musket, Merrill conversion (?).

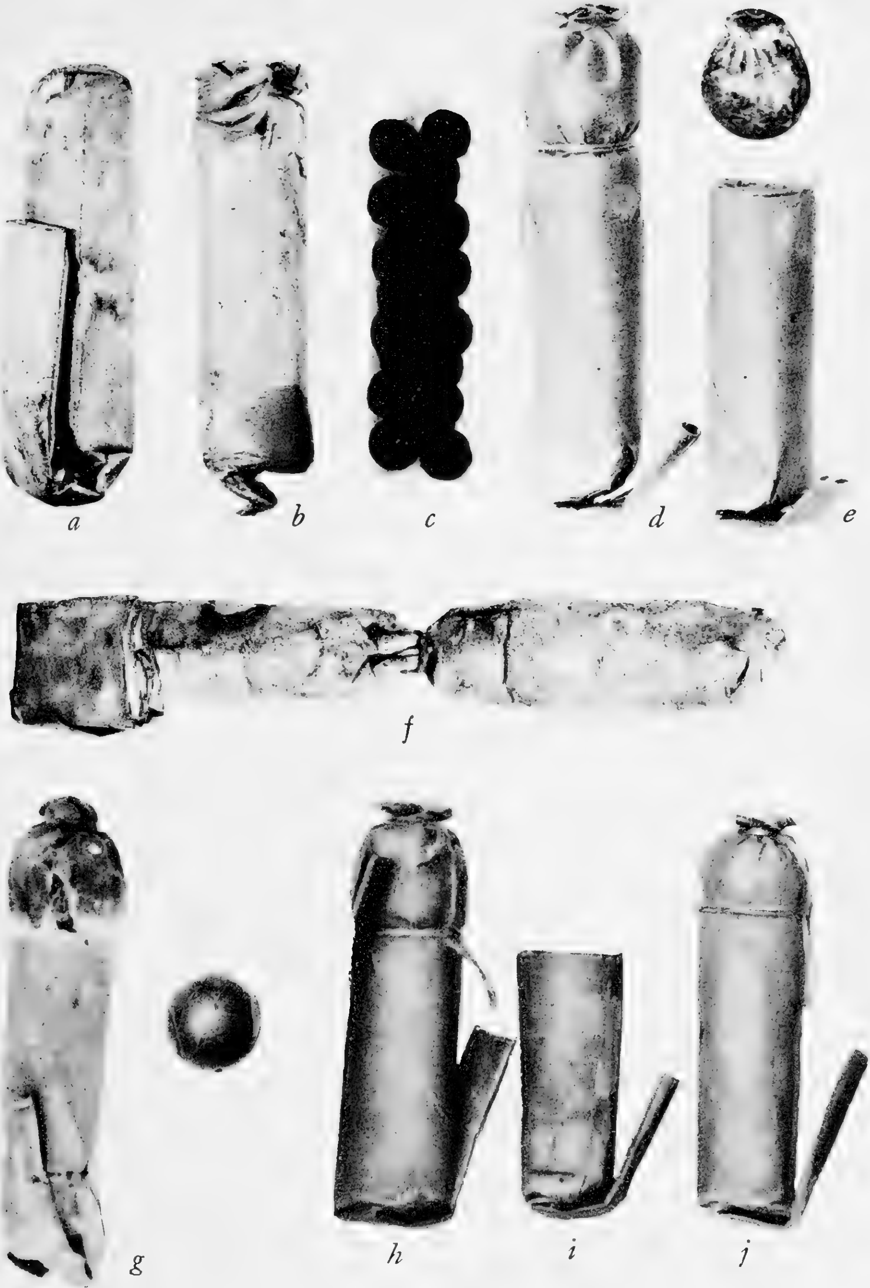


Plate 27.—CARTRIDGES FOR CALIBER 0.54 RIFLES AND HALL'S RIFLES: *a*, Buck and ball, French style, 1812-30; *b*, Buckshot, British style, 1812-30; *c*, X-ray of *b*, showing shot distributed through powder; *d*, ball, models 1804 and 1819 flint rifles; *e*, blank for same and patched ball; *f*, buckshot, British style, perhaps for cadet musket; *g*, ball, model 1819 Hall's rifle and bare ball used; *h*, ball, model 1841 percussion rifle (1849 Ordnance Manual); *i*, blank, same; *j*, ball, caliber 0.52 Hall's carbine (1849 Ordnance Manual).

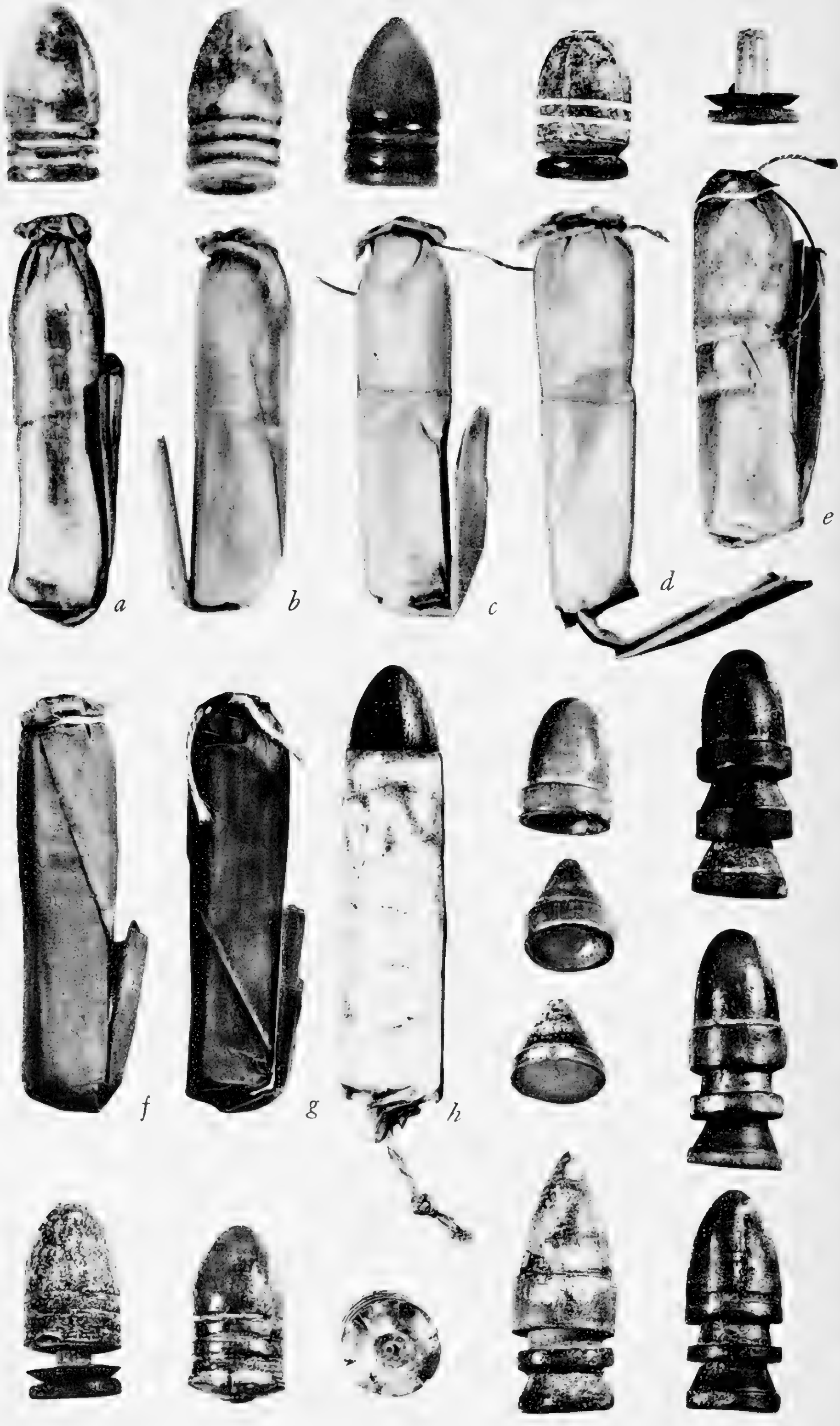

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Plate 28.—Cartridges for calibers 0.54 and 0.58 rifles: *a,* Elongated ball, caliber 0.54 rifle, 570-grain bullet above; *b,* same, 455-grain bullet above; *c.* Minié-type ball, caliber 0.58 rifle, bullet above; *d,* corresponding William's-bullet cartridge, 465-grain bullet above; *e,* same, for pistol-carbine or Union machine gun; *f,* same, for rifle, red paper, 565-grain type II Wms bullet below; *g,* same, blue paper, 565-grain type I Wms bullet below; *h,* Shaler's sectional bullet, with five variants of bullet.

Plate 29.—EXPLOSIVE-BULLET CARTRIDGES FOR RIFLES: *a*, Experimental bullets with copper nose insert; *b*, explosive bullet for foreign musket; *c*, Jacobs explosive bullet; *d*, Gardiner explosive, caliber 0.58; *e*, Gardiner, caliber 0.50; *f*, Gardiner; *g*, variant Gardiner; *h*, explosive shell (CSA?), caliber 0.69 *i*, CSA explosive, caliber 0.577; *j*, same, damaged by deteriorating bullet; *k*, bullet from *j*; *l*, bullets from *h* and *i*; *m*, explosive bullet, CSA, caliber 0.54, and base of *l*.

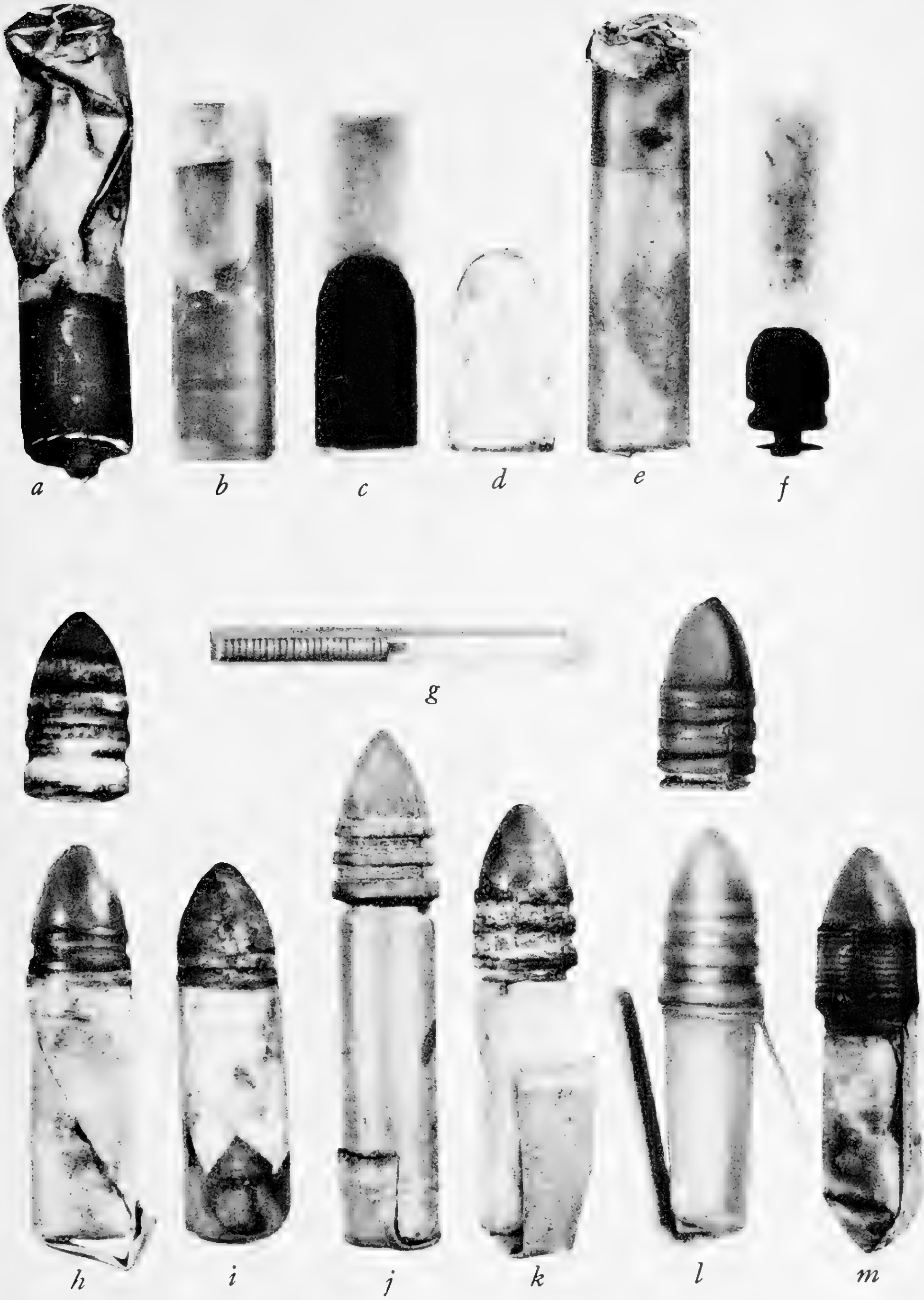

Plate 30.—Sharps and Greene rifle and carbine cartridges: *a*, Greene rifle, caliber 0.54; *b*, Greene carbine, caliber 0.54; *c*, X-ray of *b*, showing position of bullet; *d*, bullet from *a; e*, Greene carbine, caliber 0.44 *f*, X-ray of *e*, showing William's patent bullet; *g*, tube of Sharps pellet primers; *h*, early Sharps paper, carbine, and bullet; *i*, commercial Sharps paper, blue base; *j*, Sharps rifle, 1858; *k*, Sharps carbine, 1858; *l*, Sharps carbine, 1861, and bullet; *m*, Sharps carbine, unknown origin.

Plate 31.—Pistol and pistol-carbine cartridges: *a*, Ball, caliber 0.69, converted pistol; *b*, blank, caliber 0.69, British type, 1810-20; *c*, ball, caliber 0.54, model 1816-27 pistols; *d*, blanks, caliber 0.54, Harpers Ferry pistol, 1810-20; *e*, blank caliber 0.54, 1820-34; *f*, ball, caliber 0.54, for model 1819-36 pistols (1841 Ordnance Manual); *g*, blank, same; *h*, blank, same (1839 Ordnance Manual); *i*, ball, caliber 0.54, percussion, 1842; *j*, ball, same (1849 Ordnance Manual); *k*, blank, same; *l*, ball, caliber 0.58, pistol-carbine; *m*, elongated bullet for *l*; *n*, William's patent bullet, for pistol-carbine; *o*, William's bullet from *n*.

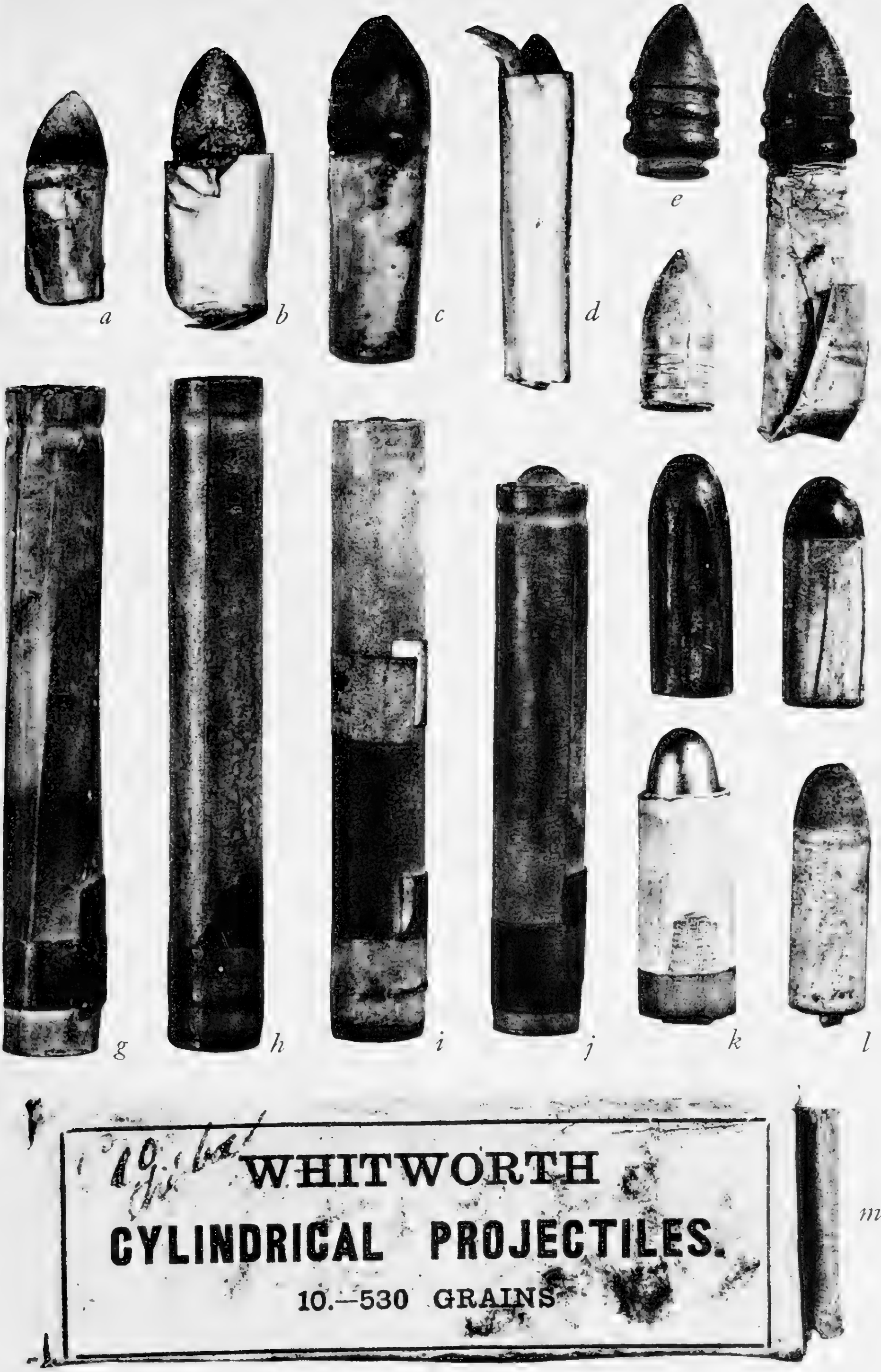

Plate 32.—Confederate-made and purchased cartridges: *a*, Caliber 0.44 for Colt's revolver, Richmond Laboratory; *b*, caliber 0.56 for Merrill carbine; *c*, caliber 0.58 for caliber 0.56 Colt's rifle, Selma Arsenal; *d*, caliber 0.37 for Maynard carbine; *e*, bullets from Sharps and Kerr rifles; *f*, caliber 0.52 Sharps rifle; *g*, caliber 0.45 Whitworth rifle (hexagonal bullet), 45/85; *h*, same (cylindrical bullet); *i*, same, 45/70; *j*, same, 45/60; *k*, hexagonal Whitworth bullet, bare and in case; *l*, patched hexagonal and cylindrical Whitworth bullets; *m*, package of 10 caliber 0.45 Whitworth bullets.

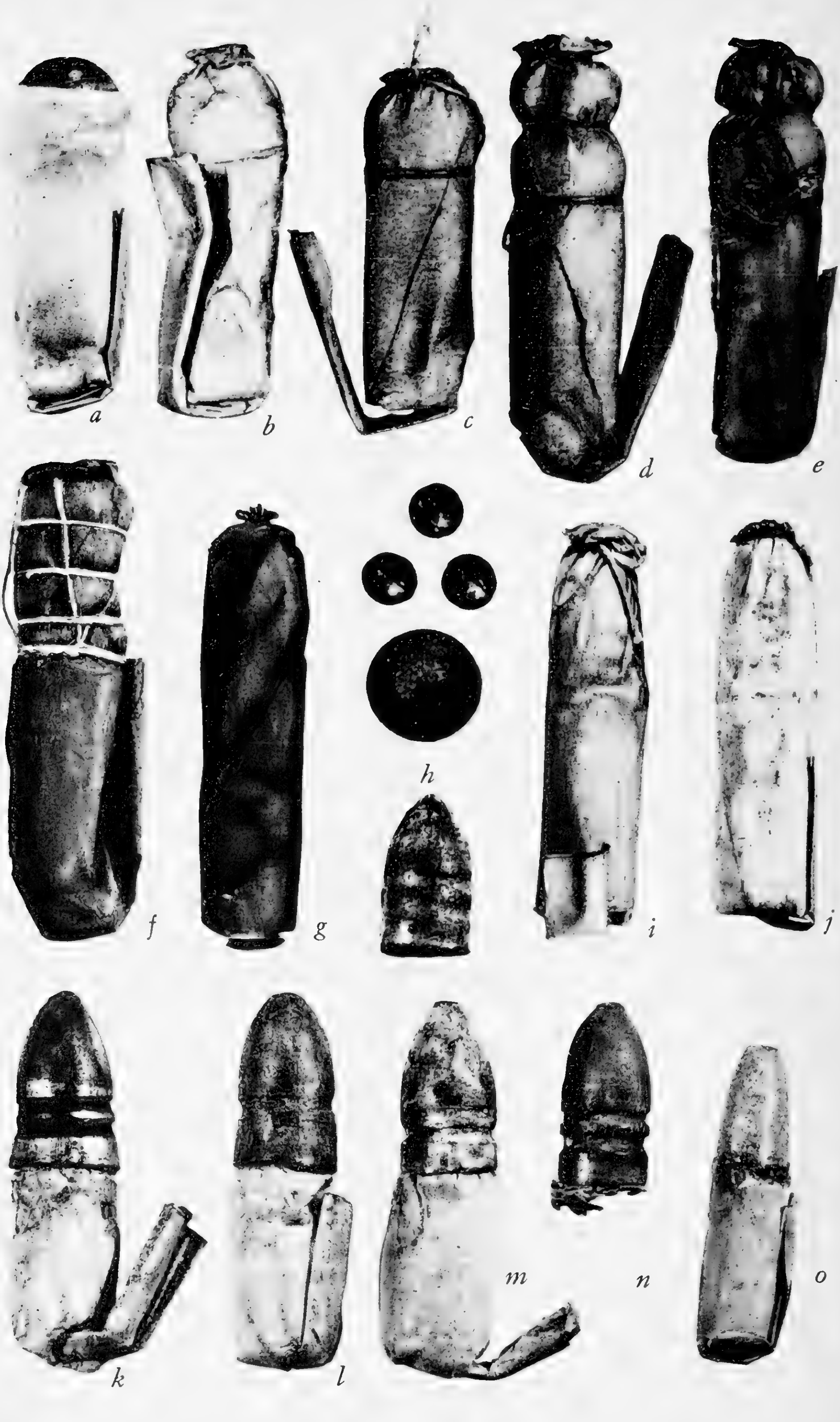
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Plate 33.—Confederate-made cartridges: *a,* Ball, caliber 0.69 musket, Selma Arsenal; *b,* same, Richmond Arsenal, 1863; *c,* same, Augusta Arsenal, 1863; *d,* buck and ball, caliber 0.69 musket, Richmond Arsenal; *e,* same, New Orleans Arsenal; *f,* buckshot, caliber 0.69 musket, New Orleans Arsenal; *g,* buck and ball, same; *h,* ball and buckshot from *g,* bullet from *i,* solid base; *i,* ball, caliber 0.54 rifle, salmon paper; *j,* ball, caliber 0.577 rifle, Macon Arsenal; *k,* ball, inserted paper, caliber 0.69 musket; *l,* ball, inserted paper, caliber 0.64 Hall's carbine (?); *m,* ball, inserted paper, caliber 0.577 rifle; *n,* ball, inserted paper, caliber 0.54 (incomplete); *o,* ball inserted paper, caliber 0.45, unknown origin.

Plate 34.—British Service cartridges, 1835-1865: *a*, Ball, carbine, caliber 0.62; *b*, ball for Minié musket, model 1835-51, caliber 0.702; *c*, X-ray showing position of cylindrical ball; *d*, ball, Sea Service musket, model 1842, caliber 0.731 (yellow paper); *e*, ball, pistol, caliber 0.75; *f*, ball, pistol, caliber 0.62; *g*, ball, Whitworth, caliber 0.45; *h*, X-ray of *g*, showing stick and wads; *i*, ball, Enfield rifle, model 1853; *j*, same (contract Ludlum); *k*, same (contract Eley); *l*, bullets, Minié type, with wood plugs, calibers 0.577 and 0.731.

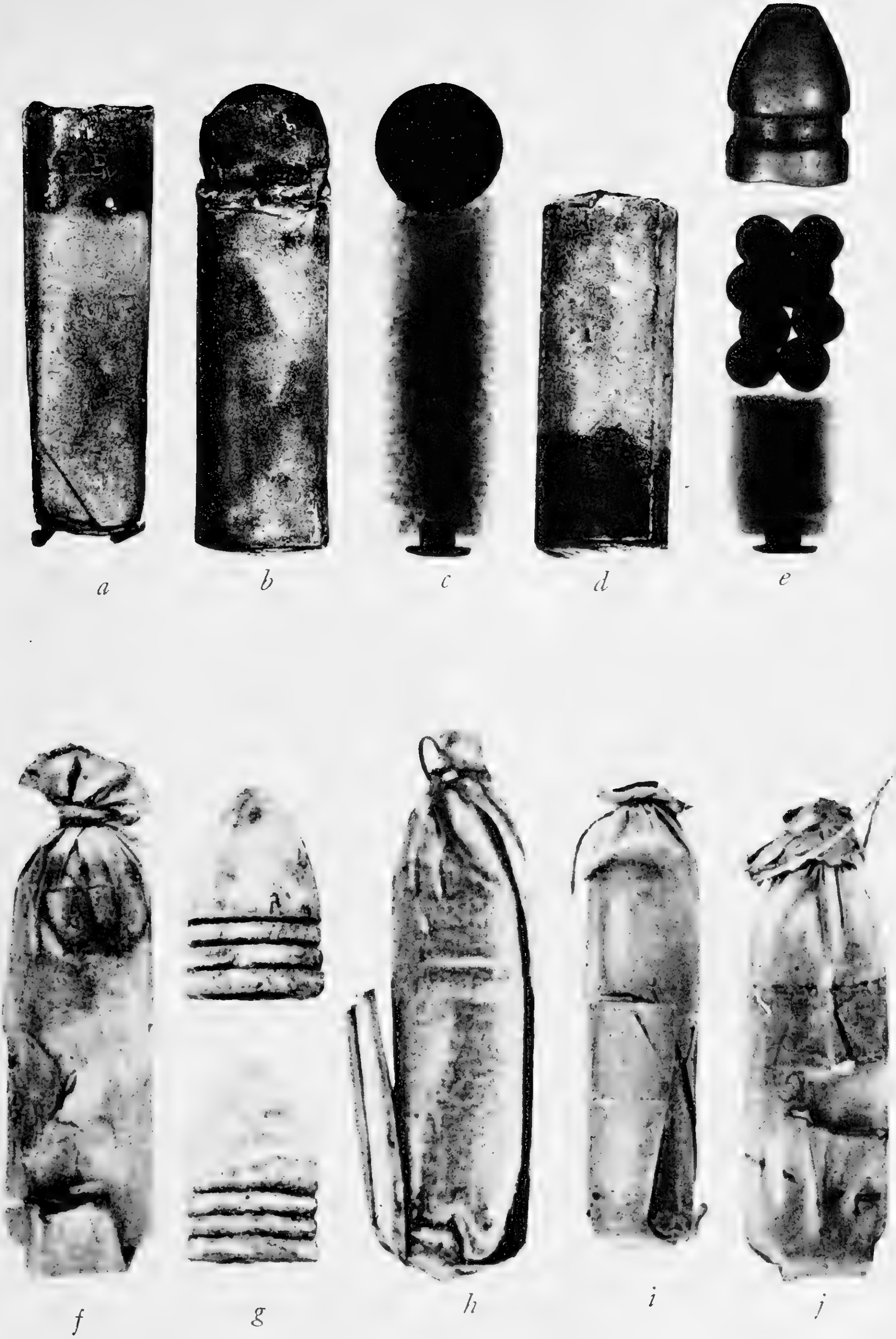

Plate 35.—Cartridges for foreign arms used in the United States: *a*, French conical ball for model 1842-63 rifled musket, caliber 0.71; *b*, French ball for converted musket, caliber 0.70, center fire; *c*, X-ray of *b*, showing inserted primer in base; *d*, French buckshot, caliber 0.70, center fire; *e*, X-ray of *d*, showing details, and ball from *a*; *f*, Austrian ball for rifled musket, caliber 0.71; *g*, bullets for *f* and *j*; *h*, Austrian ball for rifled musket, caliber 0.70; *i*, American-made for caliber 0.577 Enfield rifle; *j*, Belgian ball for rifled musket, caliber 0.70.


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Plate 36.—Paper and linen cartridges for carbines and revolvers: *a*, Starr carbine, caliber 0.54, linen and bullet; *b*, Sharps carbine, caliber 0.52, linen and bullet; *c*, Union carbine, caliber 0.50, linen and bullet; *d*, Jenks carbine, caliber 0.50, linen (Merrill's alteration?); *e*, unknown, caliber 0.50, linen (Perry ?); *f*, Colt Army revolver, caliber 0.44, linen; *g*, Colt Navy revolver, caliber 0.36, linen; *h*, Colt Navy revolver, blank, paper; *i*, Colt Navy revolver, caliber 0.36, paper, 150-grain bullet; *j*, Colt Army revolver, caliber 0.44, paper, 212-grain bullet; *k*, bullet from *l*; *l*, Merrill carbine, caliber 0.56, paper; *m*, Gibbs carbine, caliber 0.54, paper, *n*, Union carbine, caliber 0.50, paper; *o*, bullets for Colt's Walker, Dragoon, and Army revolvers; *p*, Colt Dragoon revolver, 232-grain bullet (yellow paper); *q*, same, 212-grain bullet; *r*, same, blank; *s*, Colt Army revolver, shellac over paper; *t*, Colt Navy revolver, shellac over paper.

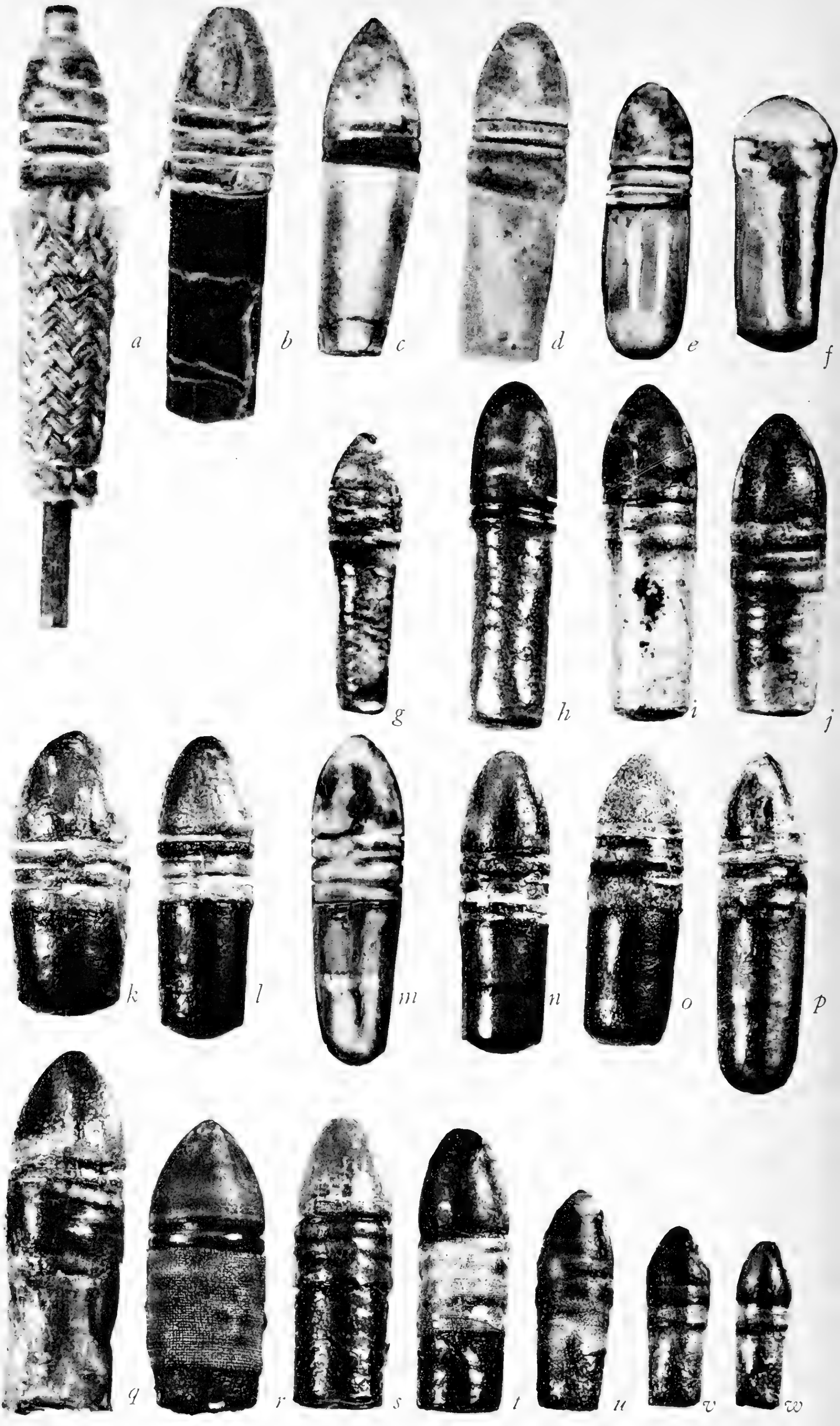
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Plate 37.—COMBUSTIBLE CARTRIDGES: *a*, Von Lenk's gun-cotton, caliber 0.58; *b*, Barlow's patent, nitrated paper, caliber 0.54; *c*, Colt's caliber 0.56 rifle; *d*, same, as made at Selma Arsenal, CSA; *e*, Hayes's patent, caliber 0.54 rifle, minus cover; *f*, (?) Hazard's caliber 0.64 musket (round ball); *g*, Johnston and Dow's caliber 0.46 revolver; *h*, J&D caliber 0.52 Sharps; *i*, J&D caliber 0.574 Enfield; *j*, J&D caliber 0.58 rifle; *k*, Hazard's caliber 0.69 rifled musket; *l*, Hazard's caliber 0.58 rifle; *m*, Hazard's caliber 0.56 Colt's rifle; *n*, Hazard's caliber 0.54 rifle; *o*, Hazard's caliber 0.52 Sharps carbine; *p*, Hazard's caliber 0.52 Hall's carbine; *q*, Bartholow's caliber 0.69 rifled musket; *r*, Bartholow's caliber 0.69 rifled musketoon; *s*, Bartholow's caliber 0.58 rifle; *t*, Bartholow's caliber 0.54 rifle; *u*, Bartholow's caliber 0.44 revolver; *v*, Bartholow's caliber 0.36 revolver; *w*, Bartholow's caliber 0.31 revolver.

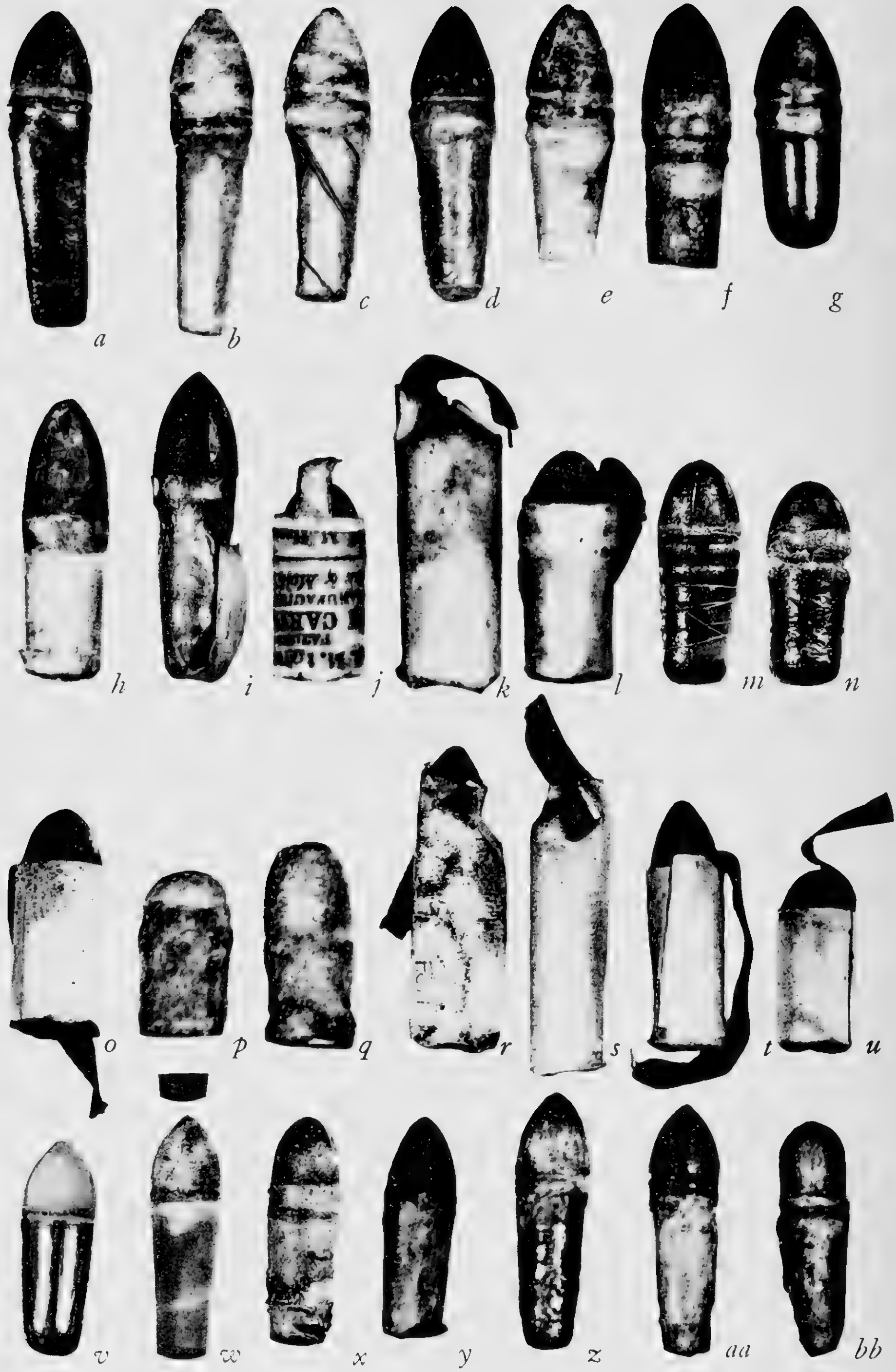
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Plate 38.—Combustible cartridges: *a*, Colt's combustible envelope, caliber 0.44; *b*, Johnston and Dow's, caliber 0.46; *c*, Sage waterproof, caliber 0.44; *d*, Sage seamless, caliber 0.44; *e*, Colt's paper combustible, caliber 0.44; *f*, Bartholow's caliber 0.44; *g*, Hazard's, caliber 0.44; *h*, Watervliet Arsenal, caliber 0.44; *i*, Colt's skin, caliber 0.44; *j*, Hayes's, caliber 0.44; *k*, Eley combustible envelope, caliber 0.44 Colt; *l*, Eley combustible, caliber 0.442 Adams; *m*, same, removed from case; *n*, Eley, caliber 0.443 Webley, removed from case; *o*, same, in case; *p*, Eley foil, caliber 0.442 Adams; *q*, Eley foil, caliber 0.44 Colt's; *r*, Eley foil, caliber 0.44 Colt; *s*, Eley foil, caliber 0.36 Colt; *t*, Eley combustible, caliber 0.36 Colt; *u*, Eley combustible, caliber 0.36 Adams; *v*. Hazard's, caliber 0.36; *w*, explosive tip, caliber 0.36, with tip element above; *x*, Remington, caliber 0.36; *y*, Watervliet, caliber 0.36; *z*, Sage seamless, caliber 0.36; *aa*, Sage Whitney, caliber 0.36; *bb*, Sage Savage, caliber 0.36.


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Plate 39.—METALLIC CARTRIDGES (miscellaneous types, external priming): *a,* Morse, caliber 0.58; *b,* Morse, caliber 0.54; *c.* Morse, caliber 0.50, CSA carbine; *d.* Morse, caliber 0.48; *e,* section of *b,* rubber disk below; *f,* bases of *a* and *d;* *g,* Poultney's patent, caliber 0.54 Burnside; *h,* Burnside, caliber 0.54, first model; *i,* Burnside, caliber 0.54 Frankford Arsenal, tinned; *j,* Burnside, caliber 0.54; *k,* Burnside, caliber 0.54 dished base; *l,* Gallager bullets, *m,* Poultney's patent, caliber 0.50 Gallager, diagonal seam; *n,* same, straight seam; *o,* soldered foil, Gallager; *p,* Jackson's patent, Gallager, tinned iron case; *q,* brass case, Gallager; *r,* same, paper lined, bullet above.


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Plate 40.—MISCELLANEOUS CARBINE AND RIFLE CARTRIDGES: *a*, Poultney's patent, caliber 0.50 Maynard carbine, diagonal seam; *b*, same, straight seam; *c*, brass case, caliber 0.50 Maynard, pointed bullet; *d*, same, flat-nosed bullet; *e*, same, tinned case, Frankford Arsenal; *f*, same, light bullet and reduced charge; *g*, rubber case, Smith carbine, caliber 0.56; *h*, same, caliber 0.52; *i*, same, caliber 0.50; *j*, same, caliber 0.48, bullets above; *k*, heavy paper case, Smith, caliber 0.48; *l*, soldered foil case, Smith, caliber 0.52; *m*, Poultney's patent, Smith, caliber 0.52 diagonal seam; *n*, same, variant seam; *o*, same, variant; *p*, Crispin patent, Smith rifle, caliber 0.50; *q*, same, carbine; *r*, same, caliber 0.50 variant; *s*, same, caliber 0.44.

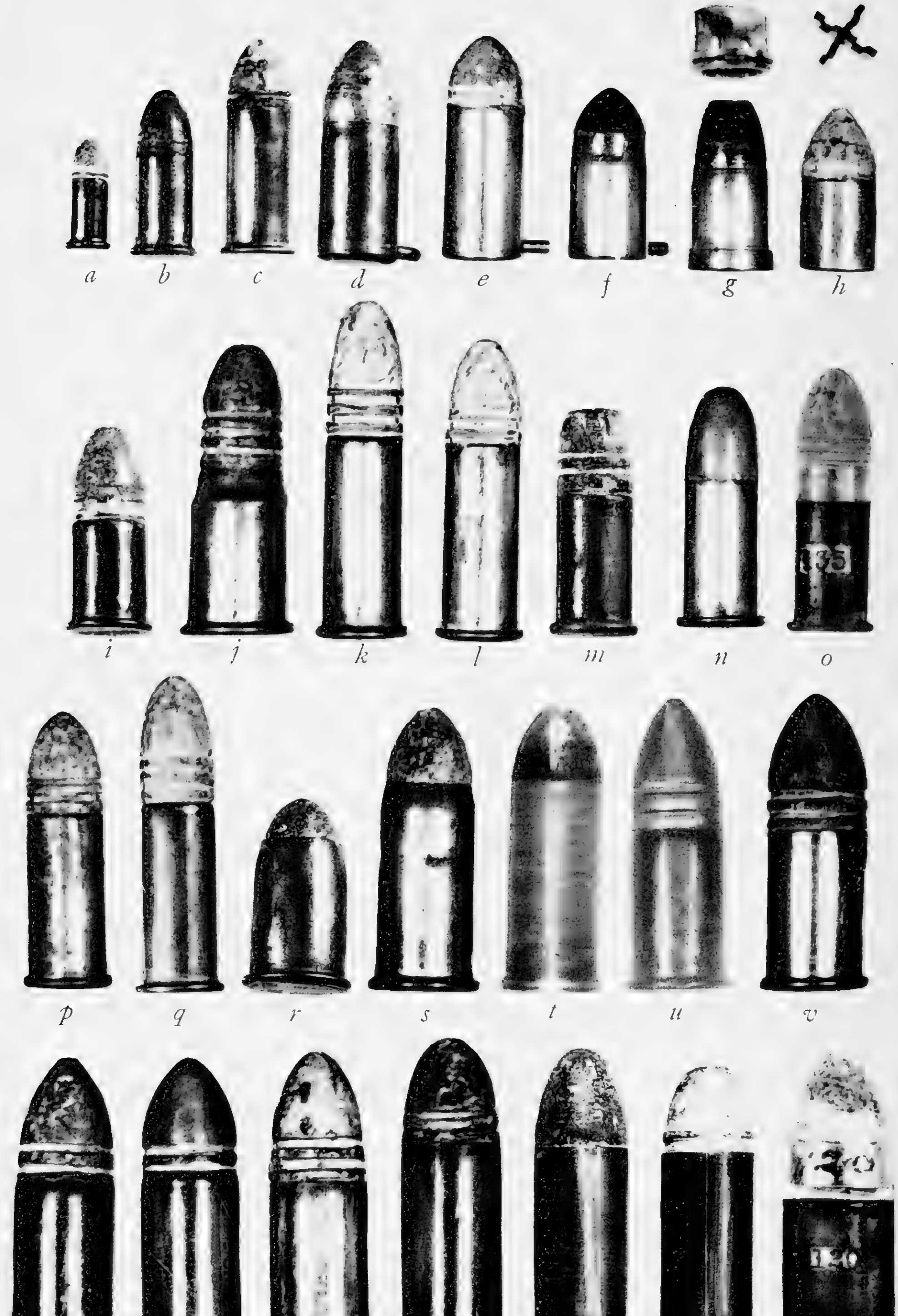
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Plate 41.—Pin- and rim-fire metallic cartridges: *a*, S&W revolver, caliber 0.22; *b*, S&W revolver, caliber 0.32; *c*, Prescott Navy revolver, caliber 0.38; *d*, 12 mm. pin-fire revolver, C. D. Leet; *e*, same, French manufacture; *f*, same, Houllier & Blanchard; *g*, 11 mm. Perrin revolver, inside-primed, anvil shown above; *h*, 12 mm. Rafael revolver, inside-primed, anvil above; *i*, Hammond pistol, caliber 0.44; *j*, Spencer rifle, caliber 0.44; *k*, Howard and Ballard rifles, caliber 0.44; *l*, Ballard carbine, caliber 0.44, by S&W; *m*, Henry, caliber 0.44, flat; *n*, same, pointed bullet, New Haven Arms Co.; *o*, Ball & Palmer and Ballard, caliber 0.44; *p*, Ballard rifle, caliber 0.45; *q*, Remington carbine, caliber 0.46; *r*, Ball carbine, caliber 0.50; *s*, Spencer carbine, caliber 0.50; *t*, Ballard carbine, caliber 0.54, "Old Model"; *u*, Spencer, caliber 0.56 by Crittenden & Tibbals; *v*, same, by Frankford Arsenal; *w*, same by S&W; *x*, same, by Spencer "Navy & Infantry size"; *y*, Joslyn carbine, caliber 0.54; *z*, Sharps & Hankins rifle, caliber 0.55; *aa*, same, variant; *bb*, same, carbine; *cc*, Allin conversion, caliber 0.58 Springfield.

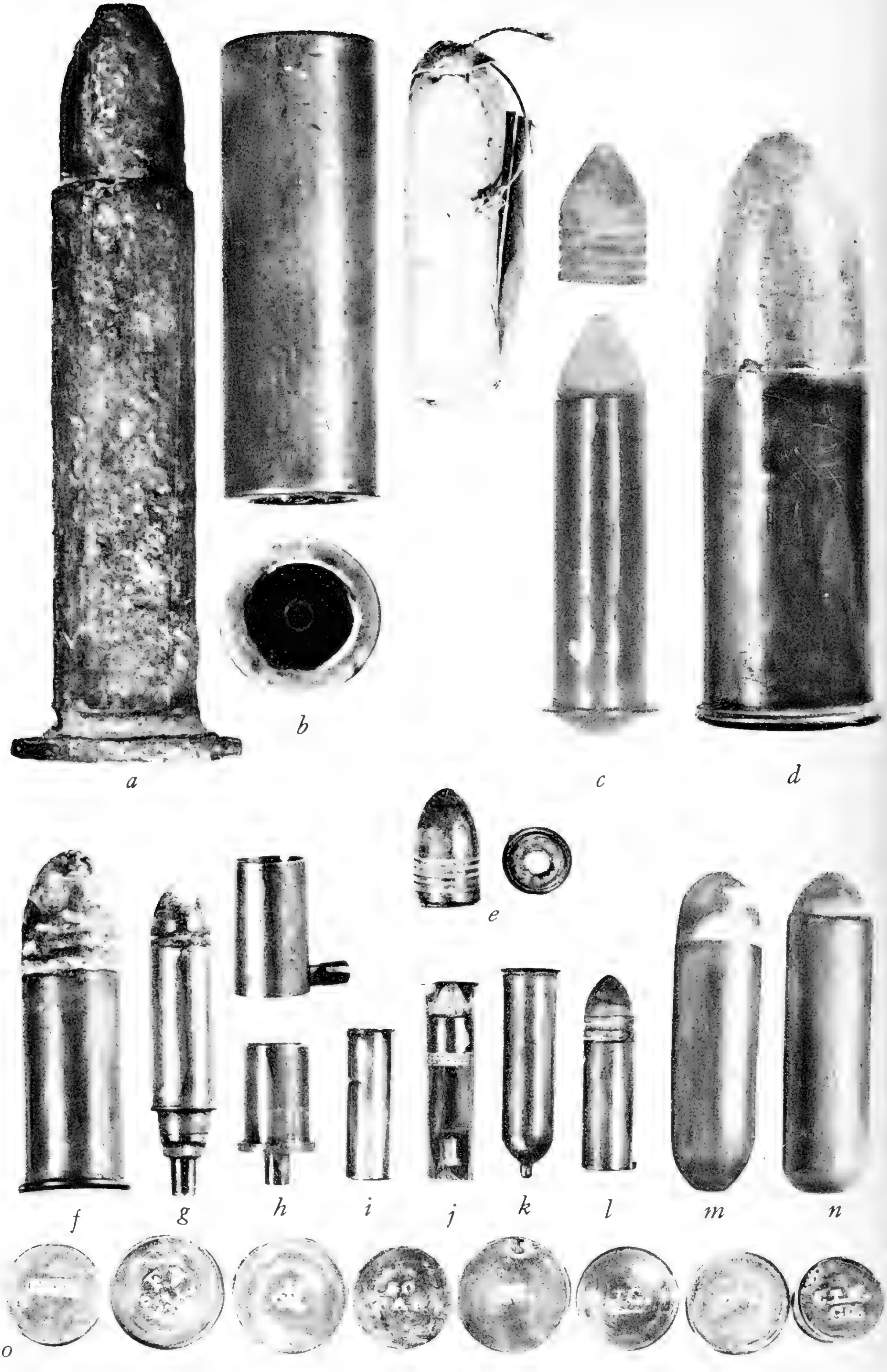
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PLATE 42.—METALLIC CARTRIDGES FOR MACHINE GUNS AND PATENT ARMS: *a*, Unknown, caliber 0.80, believed first Gatling gun; *b*, steel chamber, Union machine gun, with special Williams-bullet-reduced-load cartridge; *c*, Billinghurst & Requa battery gun and bullet; *d*, rim-fire Gatling gun, caliber 1 inch; *e*, (center) Volcanic, caliber 0.41, pistol, showing primer in base; *f*, rim-fire Gatling gun, caliber 0.58; *g*, Cofer (CSA), caliber 0.38 revolver; *h*, steel auxiliary chambers for 12-mm. pin-fire revolver and for caliber 0.44 Hammond pistol; *i*, front-loading revolver, caliber 0.28, cup primer; *j*, same, caliber 0.30, Milbank primer; *k*, same, caliber 0.30, teat-fire; *l*, Allen lip-fire, caliber 0.30, revolver; *m*, described by Pitman as Union carbine but seems variant Gallager; *n*, same as last, another variant; *o*, head stamps found on rim-fire cartridges of Civil War period: CDL (C. D. Leet), FVV&C (Fitch, Van Vechten & Co.), 58CAL, 50CAL, J. G. (Julius Goldmark), J. G., SAW (Sage Ammunition Works), C.T.M.Co. (Crittenden, Tibbals Manufacturing Co.).


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Plate 43.—TRIAL AND EXPERIMENTAL CARTRIDGES: *a*, Morse carbine, caliber 0.54, 1857 trials; *b*, Maynard conversion, caliber 0.69, 1857 trials; *c*, same; *d*, Sharps rifle, caliber 0.38, 1857 trials; *e*, same, a civilian model variant, caliber 0.36; *f*, Gallager & Gladding patent, caliber 0.61, for Schubarth caliber 0.58 conversion, 1860 trials; *g*, Maynard self-primed (1866) for converted rifle, caliber 0.58; *h*, Maynard conversion, caliber 0.58, same system as *c*; *i*, Maynard self-primed, caliber 0.50, same system as *g*; *j*, priming covers for *g* and *i*; *k*, wrapped case, center-fire, caliber 0.50, FA1865; *l*, Meigs patent conversion, caliber 0.58, 1863 (?); *m*, Montstorm, caliber 0.61, conversion for caliber 0.58 rifle, 1860 trials; *n*, caliber 0.42 disk anvil, Williams bullet; *o*, same, caliber 0.45; *p*, caliber 0.50, disk anvil, FA1865; *q*, bullet from *n* above, disk anvil from *p*; *r*, Springfield 1865 series, rim-fire, 0.50-60-400; *s*, same, 0.44-40-350; *t*, same, 0.44-40-300; *u*, same, 0.44-40-300; *v*, same, 0.44-45-350; *w*, same, 0.44-45-500.

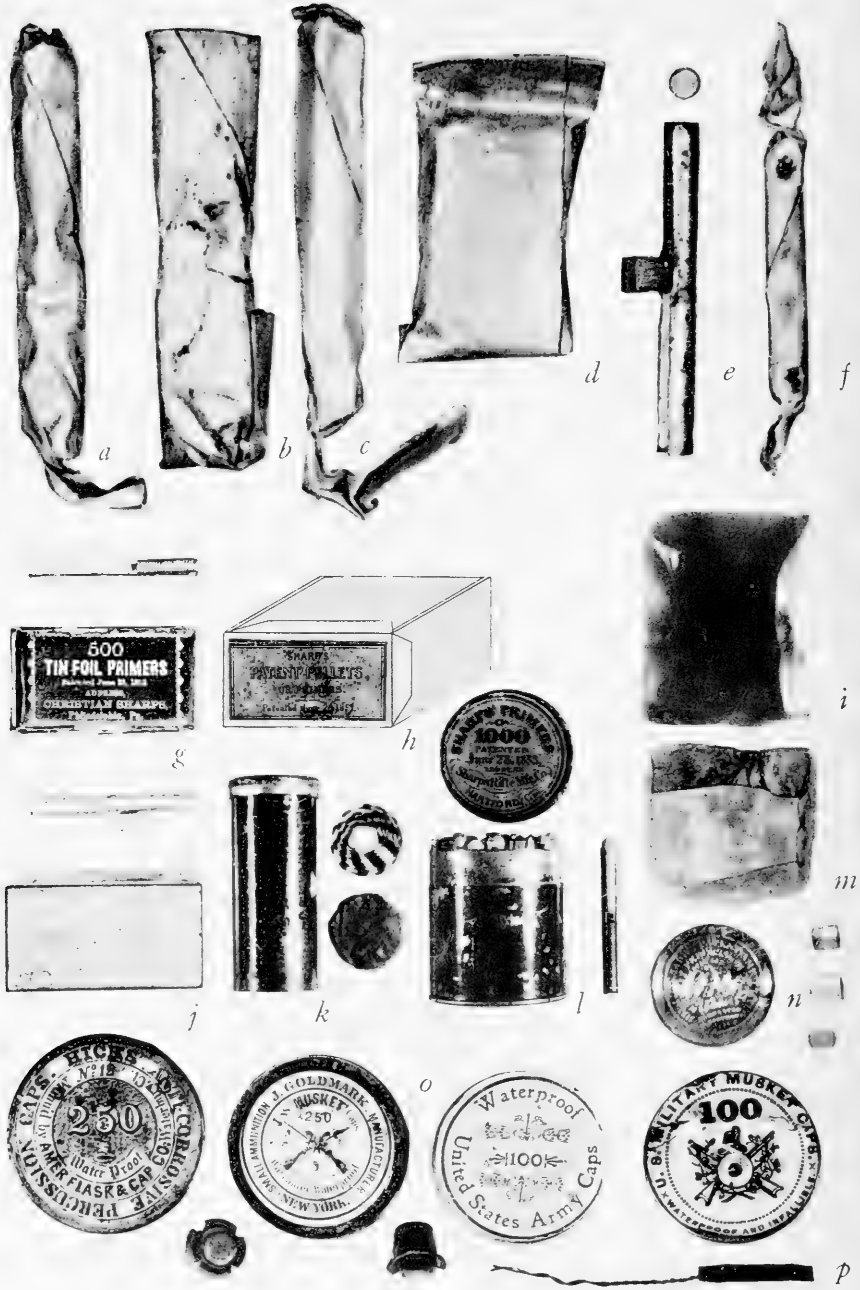

Plate 44.—Ignition (full size except *g*, *h*, *j*, *k*, *l*, *n*, *o*, $\frac{1}{2}$ size): *a*, Packet of 10 caps for Maynard carbine; *b*, packet of 12 caps for caliber 0.58 rifle; *c*, packet of 12 caps for caliber 0.69 rifled musket; *d*, packet of tape primers, M1855; *e*, tube, pellets for Sharps carbine; *f*, packet of 8 caps for revolver; *g*, can of Sharps primers; *h*, same, foil-lined; *i*, musket flint; *j*, can of Sharps primers, C. W. carbine; *k*, can of Maynard primers for M1855 arms; *l*, can of Sharps primers; *m*, pistol flint; *n*, can of 100 revolver caps; *o*, cans of musket caps; *p*, tube primer for Austrian Consol musket.

Plate 45.—Packages of paper ammunition: *a*, 10 rifle-musketoon, caliber 0.69; *b*, 10 musket buck and ball, caliber 0.69; *c*, 10 rifle, caliber 0.58; *d*, 10 rifle, caliber 0.58.

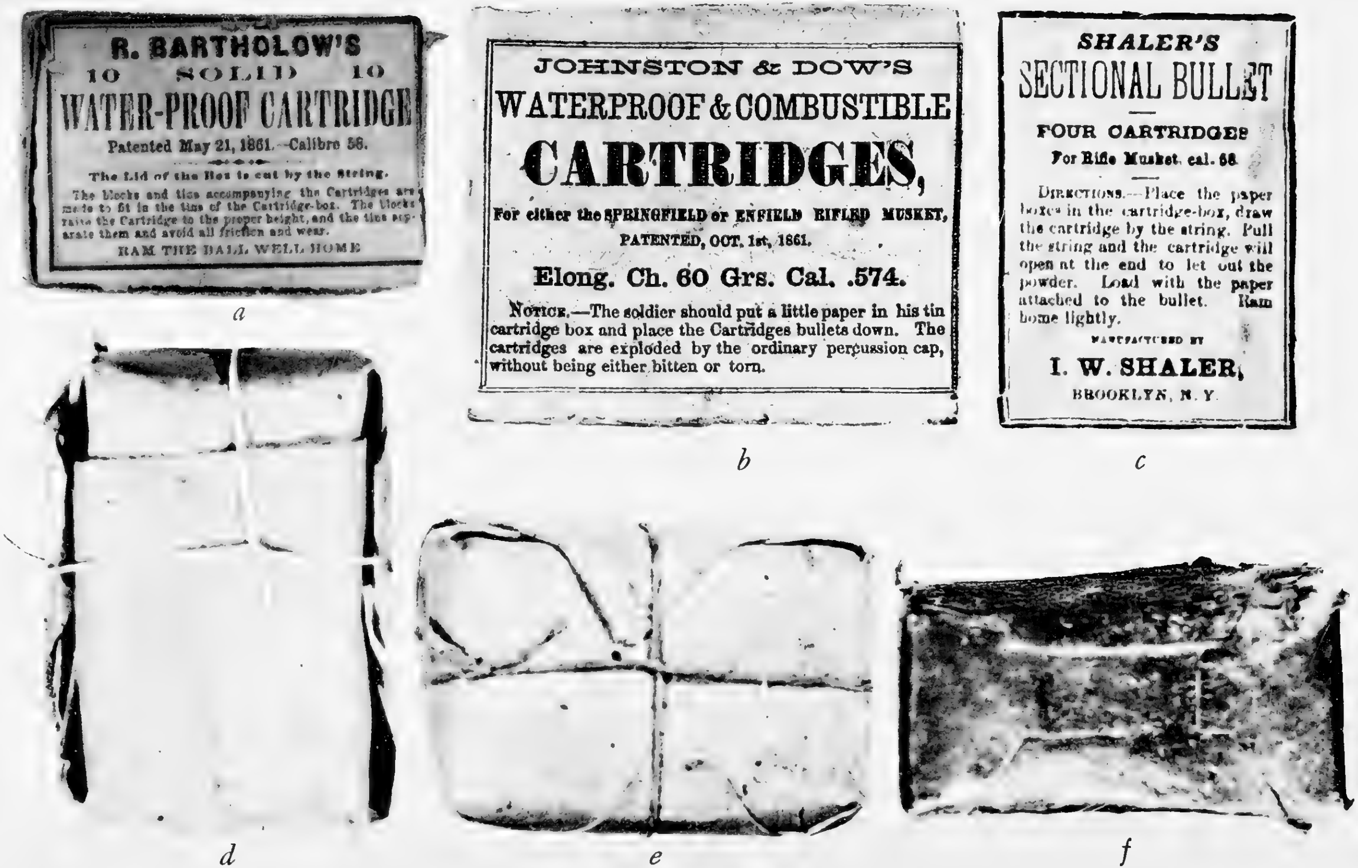

Plate 46.—PACKAGES OF PAPER AND PATENTED CARTRIDGES: *a*, Bartholow's patent, caliber 0.58 rifle; b, Johnston & Dow's, caliber 0.574 rifle; *c*, Shaler's sectional bullet, caliber 0.58; *d*, 10 pistol, ball, caliber 0.54, M1836; *e*, 10 pistol, ball, caliber 0.54, M1842; *f*, 10 pistol, blank.

Plate 47.—Package of CSA ammunition ($\frac{1}{2}$ size): *a*, Enfield rifle, caliber 0.57 or 0.58 Richmond Arsenal; *b*, musket, caliber 0.69, Richmond Arsenal; *c*, Enfield or "Minnie," caliber 0.577 or 0.58, Columbus Arsenal; *d*, musket, caliber 0.69, Augusta Arsenal; *e*, Whitworth rifle, caliber 0.45, British; *f*, musket, caliber 0.69, Selma Arsenal; *g*, Enfield rifle, caliber 0.577. Macon Arsenal; *h*, explosive bullet, caliber 0.577; *i*, Colt's revolving rifle, caliber 0.56, Selma Arsenal; *j*, musket, buck and ball, caliber 0.69, Richmond Arsenal; *k*, musket, caliber 0.69, Augusta Arsenal; *l*, Mississippi rifle, caliber 0.54, Richmond Arsenal.

Plate 48.—PACKAGES OF SPECIAL CARTRIDGES (½ size): *a*, Merrill carbine, caliber 0.56; *b*, Smith carbine (rubber case), caliber 0.50; *c*, same, Poultney patent; *d*, Maynard carbine, caliber 0.50, Poultney patent; *e*, Maynard carbine, Frankford Arsenal; *f*, Maynard rifle, caliber 0.37, CSA; *g*, Gallager carbine, caliber 0.50, Poultney patent; *h*, Sharps rifle, 32-bore (caliber 0.52); *i*, Sharps rifle, linen case, caliber 0.52; *j*, Starr rifle, linen case, caliber 0.54; *k*, Burnside carbine, caliber 0.54.

Plate 49.—Packages of metallic cartridges (½ size): *a*, 12-mm. pin-fire, French, Houllier Blanchard; *b*, same, C. D. Leet; *c*, Henry, caliber 0.44, New Haven Arms Co.; *d*, Burnside rifle, caliber 0.54, early label; *e*, Remington carbine, caliber 0.46, Crittenden & Tibbals; *f*, No. 56 Ballard carbine, caliber 0.54, C. D. Leet; *g*, No. 56 Joslyn carbine, caliber 0.54, C. D. Leet; *h*, same, Crittenden & Tibbals; *i*, Spencer carbine, caliber 0.50, Sage; *j*, same, Goldmark; *k*, Spencer rifle, caliber 0.52, Spencer, package of 42; *l*, same, package of 10; *m*, same, 42, Crittenden & Tibbals; *n*, Spencer and Joslyn, caliber 0.52, Crittenden & Tibbals; *o*, same, C. D. Leet; *p*, 12-mm. Perrin revolver.

Plate 50.—Packages of combustible cartridges (not to scale): *a*, Colt's caliber 0.56 rifle; *b*, Colt's caliber 0.44 pistol; *c*, same, opened; *d*, Colt's Army pistol, Hazard Powder Co.; *e*, Bartholow's Army pistol; *f*, Johnston & Dow's caliber 0.46 Army revolver; *g*, Watervliet caliber 0.44 Army revolver; *h*, Sage waterproof caliber 0.44 Army pistol; *i*, same, seamless; *j*, Johnston & Dow's caliber 0.46, by Elam O. Potter; *k*, combustible envelope, caliber 0.44; *l*, Starr Navy pistol; *m*, combustible envelope, caliber 0.36; *n*, Sage seamless caliber 0.36 Navy pistol; *o*, same, Savage revolver; *p*, same, Whitney Navy revolver, caliber 0.36; *q*, Broux, skin, caliber 0.36 revolvers; *r*, explosive tip, caliber 0.36, Colt's revolver.

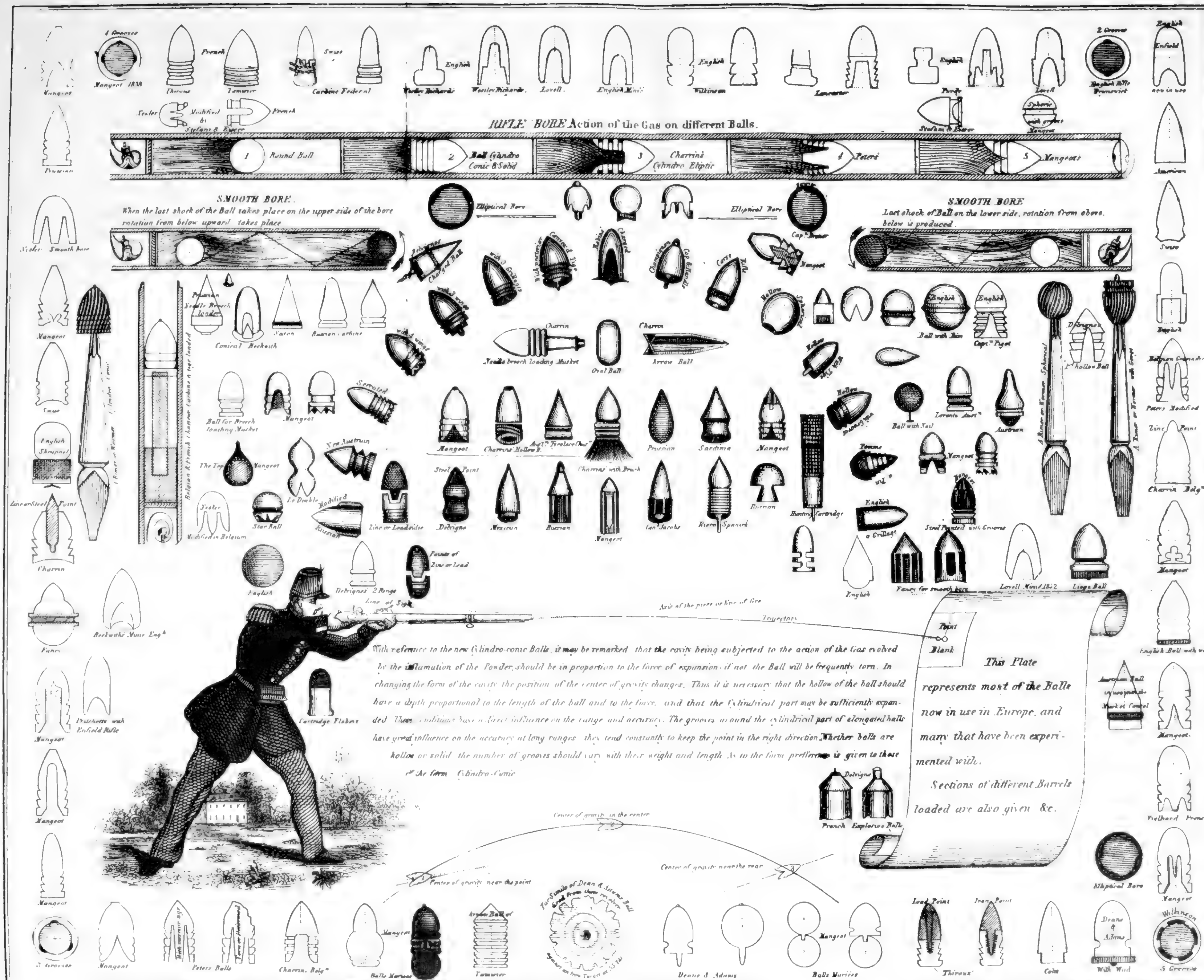

Plate 51.—BULLETS, 1850-1860, Wilcox (Mangeot).

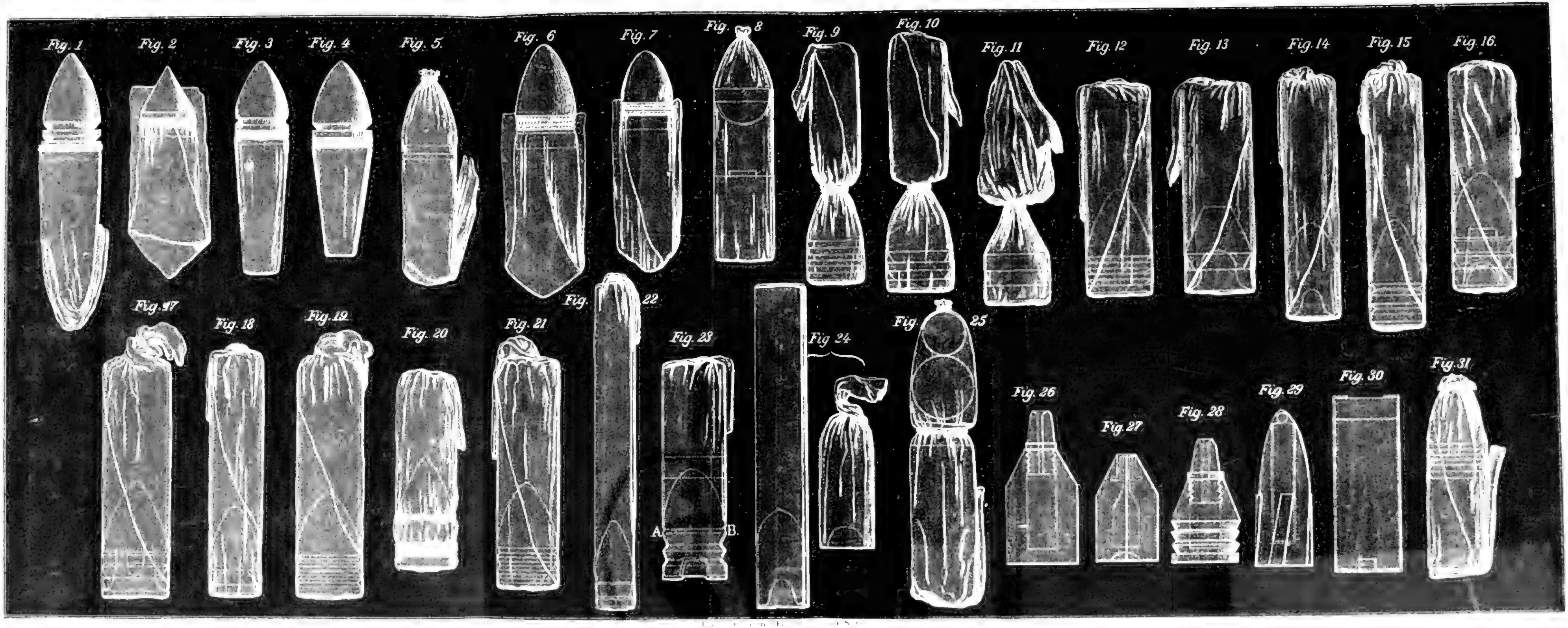
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Fig. 16.
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Fig. 18
Fig. 19
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Fig. 21
Fig. 22
Fig. 23
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Fig 24
Fig. 25
Fig. 26
Fig. 27
Fig. 28
Fig. 29
Fig. 30
Fig. 31